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Beating a Hay Shortage
Vitamins for Dairy Calves
Mulch and Hill
How You Can Kill Japanese Beetles
Stimulating Production
Your Corn-Borer Battle
Tillage Below Plow Depth
Better Pastures Depend on Soil
Mow Curing of Hay
Scientist with His Feet in the Soil
Improvement of Soil Structure
Thinning Blossoms with Chemicals
Control of Fowl Leukosis
Big Things Ahead in Cutch
Breed Sow and Litter
Time to Think About Seed Beds
Let Ants Do the Work
The Rochdale Pioneers
Pasturage Alone for Fattening Yearlings
Grass Silage for Turkeys
Heat Tops a Feed Resource
Nutrition Deficiencies of Calves
Lettuce in the Home Garden
Wood Chemistry Enters a New Age
Home-Grown Protein for Laying Hens
Swine Tuberculosis Traced to Poultry
What Is "Average" Egg Production?
"Ag" Class Operates Real Farm
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Beating a Hay Shortage

Condensed from Capper's Farmer

THIS country is short of good roughage. The number of hay-consuming animal units on farms in 1943 was nearly 1½ million greater than in the previous year, and hay production was down nearly 9 million tons. The result is 10 per cent less hay for each consuming unit at a time when shortage of other feeds calls for more. The worst aspect of the situation is that the gap between need and supply could widen materially in 1944. Whether it widens will depend on the acreage of emergency feeds grown and on the care exercised by farmers in saving all the hay they can produce by methods that will preserve its maximum feeding value.

Deficiencies of feed grains and protein supplements place great stress on the need to preserve all hay nutrients. Let's examine some figures to determine just how important that is. Analyses covering more than 150 samples of leafy alfalfa hay and nearly a hundred of stemmy hay show that it would be necessary to feed approximately $6.25 worth of linseed meal with each ton of stemmy hay to provide as much digestible protein as a ton of leafy hay contains.

A large percentage of the protein in alfalfa is in the leaves. If they are lost by letting the crop stand too long before it is cut, or if they are sifted out because the feed cures too long in the swath or by handling the hay by wasteful methods, protein content is lowered materially. The leaves also are richer in other digestible nutrients because their fiber content is low.

Nutrient losses not so well known to the average haymaker are those from bleaching, leaching and fermentation. Green color is a good index of vitamin A content. Hay that lies in the swath until it is white probably will have little left, and there will be losses of other vitamins as well, except vitamin D.

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Hay, especially from legumes, should be windrowed as soon as it is well wilted to prevent bleaching. A side-delivery rake is better than a dump rake for this purpose because the windrow is more likely to be loose enough to dry without undergoing fermentation, which robs it of carotene, starches and sugars. Speeding the cure lessens danger of damage by rain. Tobacco-brown color in alfalfa results from excessive fermentation caused by stacking, raking or cocking hay into large masses when it is too high in moisture. Livestock eat it readily, but fermentation in the curing process may destroy up to 40 per cent of the dry-matter content and a much higher percentage of the vitamins. While legumes thus cured may supply sufficient vitamins to maintain beef cattle or sheep, only bright green hay will contain enough to serve as supplement for hogs or poultry, or to supply dairy cows with sufficient carotene to produce milk of desirable color and maximum food value.

Hay exposed to excessive rain before curing is completed may lose large amounts of nutrients. A Colorado test several years ago revealed that 3 rains, totaling less than 2 inches, leached from alfalfa 60 per cent of its protein and 41 per cent of the nitrogen-free extract.

The farmer who is equipped to choose between curing and ensiling legume hay crops has the advantage of the one who cannot put the crop into a silo in wet weather. He can hay when it is dry; make silage when it rains.

The field chopper and pickup baler team well with the side-delivery rake as leaf savers. Best time to use the rake is when the forage is well wilted. It can be operated to put the hay in windrows small enough to cure without turning, and its action places the leafy portions of the swath inside the roll where they are not easily shaken out. Pickup devices on both chopper and baler feed hay into the machines in a continuous stream with the windrow so little disturbed that few leaves can be dislodged.

There was a rapid swing to portable choppers and balers before the war checked implement manufacture. These machines reduce labor requirements of haying, and they put the roughage in a condition that makes it easier to feed.

Hay needs in 1944 are so great that it will be necessary to do more than save what can be grown on acreage already established. Seed supplies are short, acreage of new stands is reduced and many older stands have thinned. It will be desirable this year to seed emergency hay crops on thousands of farms, to thicken stands that have deteriorated and

cannot be replanted because of seed shortage, and to lime and fertilize fields in which soil deficiencies exist.

The protein shortage will make soybeans one of the best emergency crops, especially for dairymen and beef feeders who would need to buy oil meal for use with Sudan, millet, sorghums and other low-protein roughages.

Probably there are some farmers who could produce a fall crop of oats hay of high feeding quality. Where there is plenty of soil moisture at harvest time, disking and seeding oats behind binder or combine might be a paying practice. There are areas from northwestern Oklahoma to Minnesota where summer-seeded oats or volunteer stands supply abundant pasture. Jay Peckham cut a volunteer stand in Pawnee county, Nebraska, for hay just as the crop was starting to head in mid-September. He sent a sample to Nebraska College of Agriculture for test and was surprised to learn the hay contained 25.4 per cent protein to make it a richer feed than the best field-run alfalfa.

It may be impossible to get all the commercial fertilizer needed this year. In such a case, it will pay to give thought to where that available may best be applied. Few crops give higher return for phosphates than the 2 principal tame hays—alfalfa and red clover, and application of superphosphate to either on needy soils usually will give hay that is higher in feeding value and heavier in yield.

Oats is more commonly used than other crops to thicken thin stands of legumes, but in some irrigated areas spring barley has proved satisfactory. Where an alfalfa stand has thinned badly, hay yield of the first cutting often may be doubled by disking in a broadcast seeding of oats early in spring. Old alfalfa fields are rich in nitrogen and it usually pays to seed the oats at the same rate as for a grain crop, and cut the mixture for hay when oats are in milk stage. Hundreds of farmers have followed this practice, which pays an additional return by keeping the stand free of weeds.

The farmer who is not sure of sufficient supplement can well sacrifice some tonnage of blade grass hays to get feed that is higher in protein. Timothy, cut in late bloom, contains less than 50 pounds of digestible protein a ton. Eight tests of timothy cut before it bloomed showed hay at that stage averaged 112 pounds of digestible protein a ton. When timothy is harvested early, a heavier aftermath is produced, and second-cutting timothy may contain 150 to 175 pounds of digestible protein a ton.

Blade grass hay, cut early and cured without too much exposure

to sun, is a richer source of vitamin A as well as protein, and dairymen who want to produce milk that is high in carotene can profit by earlier mowing.

High Levels of Vitamins A and D Fed to Dairy Calves Prove Beneficial

Condensed from Science for the Farmer

E. A. Keyes
The Pennsylvania State College

GREATER quantities of vitamins A and D than animal nutritionists formerly considered sufficient have proved of marked benefit to dairy calves. This "super-charging" of calf feed with vitamins seems also to serve in some measure as insurance against scours and associated difficulties. With vitamins readily available at a reasonable cost, their more extensive use in calf feeds appears to be an impending development.

In comparative tests calves fed extra quantities of vitamin A have been noticeably larger and sleeker in appearance than those fed a standard calf starter mixture supposedly containing sufficient vitamins. Those fed vitamin D in extra quantities also were heavier and more thrifty at the age of 16 weeks and at 12 months than the check lots. In turn, the calves fed a surplus of both vitamins were the best of all when one year of age. This margin of superiority continued during an ensuing four-month season on pasture.

Thirty-six grade and purebred Holstein calves, divided into four groups of nine each, were used in tests conducted last year. During the early part of its life while it was learning to eat calf meal, each calf was fed 350 pounds of whole milk. These calves received colostrum during the first few days of their lives and had the benefit of the additional amounts of vitamin A which it contains.

All of the calves received the same kind of clover and timothy hay and were handled under the same environmental conditions. Their basal grain ration consisted of a standard calf starter meal which contained vitamins in amounts usually considered sufficient for dairy calf needs. The calves were allowed all of the starter meal that they would eat

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until consumption averaged 4 pounds daily.

The calves in Group I were given no vitamins in addition to those contained in the starter meal. Each of those in Group II was fed approximately 2000 International Units of supplementary vitamin D per 100 pounds of live weight per day until its daily consumption of calf starter was approximately 2 pounds. In a similar manner, each calf in Group II was given the equivalent of 30 micrograms of carotene (provitamin A) per pound of live weight daily until its consumption of starter meal was 2 pounds per day. The calves in Group IV received both vitamins in the amounts given Groups II and III.

Irradiated yeast supplied the vitamin D and CAROTONE S 15 the vitamin A in the tests. Costs per calf were a fraction of a cent per day.

At the end of 16 weeks, Group III, the calves fed extra vitamin A had gained 12.7 pounds; Group II, those fed vitamin D, 7.1 pounds; and Group IV, those fed extra allowances of both vitamins, 6.5 pounds, more than those in Group I which received a standard starter meal. In addition to greater weight, those in Groups III and IV especially had sleeker coats of hair and had made greater skeletal growth. The Group I calves were noticeably the poorest. In general, x-ray pictures, blood carotene, calcium, and phosphorus determinations confirmed the physical findings.

Relative condition of the calves had changed at the end of the year only in that Group IV, the group receiving additional amounts of both vitamins A and D, then was best. This Group averaged 17.4 pounds heavier; Group III, 15.8 pounds heavier; and Group II, 15.7 pounds heavier than Group I. The calves in Group III had the best coats of hair. The skeletal growths of all three groups were similar and better than those of Group I.

After the calves had spent a summer on pasture, the groups fed the extra vitamins early in life showed further superiority over those given the standard calf meal. They were larger, had sleeker coats of hair, and carried more flesh. These results indicate that a more liberal allowance of vitamins A and D in calf starter meals are advantageous in producing strong, healthy calves.

Further evidence of the importance of vitamin A in the early days of a calf's life has been obtained in prepartum milking trials now under way. The cows in this test have been milked from 2 to 16 days previous to calving in an effort to study certain problems connected with parturition.

Last winter six cows were pre-

partum milked and four of their calves became ill, two seriously so. They had indigestion, scours, and were generally inactive. On the supposition that they might be vitamin A deficient because of not receiving colostrum, the ill calves were given 5 cc of CAROTONE S 15 per day, and at the end of a week of treatment, they appeared normal and active.

Similarly, during the past summer nine cows on pasture were prepartum milked, but not one calf from these cows became ill. These results seem to indicate that calves receiving milk from cows on good green pasture obtain enough vitamin A from it to protect them from common vitamin A deficiency diseases even if they do not receive colostrum during the first few days of their lives.

Ultraviolet Ferrets Out Spud Diseases

Ultraviolet light has been used for years to detect ring rot in seed potatoes. Now it appears that it will also discover which potatoes have virus diseases.

Colorado Experiment Station workers have found that virus-infected seed potatoes will show a fluorescence when cut and examined under ultraviolet light. For example, those infected with spindle tuber generally displayed a yellow fluorescence, while those with leafroll — or haywire — showed a white fluorescence. Several types of mosaic can also be detected.

Use of ultraviolet light for cleaning disease out of foundation stock has been tested under actual field conditions by several Colorado growers. One grower ran 600 sacks of seed under the light and found it cost him about 35 cents a sack. Through the season his crop from this seed was so much better that strangers could tell by looking at the fields which ones had "ultraviolet" seed. Fusarium, blackleg and virus diseases (as well as ring rot) were substantially reduced.

The light is believed to be the most efficient when the tubers are stored and examined at about 40° F. Examination must be made in total darkness. Best results were obtained from medium and large sized tubers, as the small ones (1½ inches in diameter) frequently failed to fluoresce.

—Farm Journal

Mulch and Hill

Condensed from Free America

Everett G. Reid

I once made a trip through the south eastern states during a bad drought. At one stop my host was a farmer on a very fertile piece of land on which the crops had dried to brown stalks. During my stay he took me for a drive into the hill country where, according to popular fiction, only the most shiftless people live but here, to my surprise, we found crops that were fairly green and prosperous.

"I don't know how they do it," said my host. "None of these people could be called farmers. Most of them don't even own a plow. They just break up the land with a hoe."

This incident came back to me four years ago when a drought so depleted our garden that the only worth-while crop it produced was a plot of tomatoes that came up voluntarily from the seed of rotten tomatoes dumped the year before on *unplowed* land.

As it is part of our home grown food plan to produce all we can with the least possible effort I was greatly impressed with this phenomenon and since then I have experimented with growing some of our garden on land that was not turned.

My system, which I call the hill and mulch method, is applicable only to small and intensively used areas such as the family garden where the most produce must be obtained from the smallest space. I cannot claim to be the originator of it as I found the basis of the idea in an old book on primitive Indian agriculture. In the beginning I used it only on such crops as are ordinarily planted as started plants, tomatoes, cabbages, melons, and peppers.

The work is begun in the fall when all mulch and plant refuse from the year's crops is carefully raked up and piled for composting. This is a very necessary step as such refuse will harbor insect pests if left on the ground over the winter. As ground that has been heavily mulched does not bake, the surface is soft and moist enough so that a few handsful of rye scattered about take root and form a winter cover crop.

In the spring the plants are set in the unturned ground and the whole surface between them is heavily mulched with well rotted two year old compost which smothers out the rye and weeds.

My next experiment was to try

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this system on seeded crops. The ordinary row method of planting does not fit into the mulch system as the mulch cannot be applied until the seedlings are well up, by which time the soil has lost a great deal of moisture and either the rye cover crop or weeds has made hoeing necessary. To overcome this I reverted to the old Indian method of planting in hills. The composted mulch is spread over the ground and at measured intervals a small spot is scraped clear in which the seed is planted. This means that plants must be used which produce the greatest returns from one root and I was delighted to find that the pole type of peas, snap beans, and limas produce more heavily and over a much longer period than do the bush types I had been planting. The first planting in each hill is about four seeds of the pole type pea. When these have reached the blossom stage four kernels of corn are pressed into the same hill. The peas are pulled when they stop producing and are added to the compost heap. By this time the corn is well up and a third crop is planted in the hills. This can be climbing beans or limas which use the cornstalks for support, or rambling vine plants such as squash, pie pumpkins, or well started melon plants. Because the growing season for the third crop is short it is necessary to select types which mature fast, the kinds seed catalogues term "early" varieties.

Although it seems to the casual eye that this method is wasteful of land as compared with row cultivation the comparative results are astonishing. On two test plots of exactly the same size which I planted last summer, one unspaded hill and mulch and the other spaded and hoed and both fertilized with equal amounts of compost, production compared as follows—the measurements are in canned products, except for the pumpkins and squash:

Product	Hill and Mulch Method	Spaded
Peas	22 pints	17 pints
Corn	33 quarts	21 quarts
Snap beans ...	17 quarts	2 quarts
Pie pumpkins .	13	none
Acorn squash .	38	6

It is noticeable that the greatest difference was shown in the third crop. This is because the plants on the mulched land grew so much faster that there was time for more of the last crop to mature before killing frosts struck.

More than twice as much seed was planted on the spaded land as on the mulched. Spading the one patch took a full day and it had to be hoed three times. Neither of these jobs was necessary on the mulched patch, but the planting took about twice as long.

Another great advantage of the hill method is that the small amount of animal manure we had is placed where it will be quickly and efficiently available and not scattered thinly over wide areas. This fall I am spreading mulch over a small area where it will be left over the winter and in the spring I will pull it aside in rows where I will try to grow such row crops as beets and carrots. I have yet to learn whether the ground will be as productive when wintered under a mulch cover as it is when planted to rye. I should mention that the hill and mulch land is revived every third year with a crop of soy beans, the plants of which are mulched under the following spring.

I would not advise anyone to cast aside old and tried methods of gardening to go in for unturned mulch gardening on a large scale as there may be differences in soil, climate, or moisture which would make it impracticable in some localities, but those who have enough space so that they can experiment without the danger of losing a precious crop may find in this method a means of improving production and cutting labor to the minimum.

Liming of Orchard Soil

Northeastern apple growers are having "sulfur" trouble these days. Necessary in their fungicide-control program, sulfur unfortunately has the property of turning soils acid. Many growers are finding they cannot grow any of the usual orchard grasses for this reason.

Scientists warn that probably more serious is the leaching out of calcium, potash and magnesium in the soils as they lost their "sweetness." Leaf scorch, early leaf fall, undersized fruit, increased pre-harvest drop, and slower tree growth have all been traced to magnesium deficiency in the trees.

Massachusetts Experiment Station workers have been working on the problem, and are recommending that growers add high magnesium (dolomitic) limestone at the rate of one to two tons per acre to acid orchard soils. Other corrective measures include adding epsom salts (a soluble magnesium form) 5 to 10 pounds per tree, and discontinuing potash applications until the magnesium content is restored. They are also warning orchardists not to use the straight calcium limestone, as it tends to aggravate rather than correct the trouble.

—Farm Journal

Now You Can Kill Japanese Beetles

Condensed from New Jersey Farm and Garden

Edgar J. Clissold

THE Department of Agriculture has found milky disease to be largely responsible for the decrease in the number of Japanese beetles that has been noted in some of the older beetle-infected areas. The department thinks so highly of this method of control that it has established milky disease colonies throughout the beetle-infested areas with the active co-operation of state agencies. It considers it most desirable to do everything possible to accelerate the natural spread and build-up of this disease.

It was at the Japanese beetle laboratory of the Bureau of Entomology and Plant Quarantine, at Moorestown, that the studies were made that make possible the war against the Japanese beetle menace by this method.

Milky disease spore dust can now be bought as easily as we buy other materials for insect control, and it is an easy product to use, requiring even less trouble than it does to top-dress a lawn with fertilizer. Therefore, the decision of the U. S. Department of Agriculture to grant a license to permit the production and packaging of milky disease spore dust makes news of the first importance to growers in the Japanese beetle zone.

Milky disease is established by simply dropping one level teaspoonful of milky disease spore dust on top of the ground in Japanese beetle grub infested turf areas at five-foot intervals in rows five feet apart. One pound of spore dust will treat 4,000 square feet of ground, and ten to eleven pounds will treat one acre.

Fortunately, milky disease is harmless to plants, humans, and domestic animals, and milky disease spore dust may be used with safety in any garden. It is an odorless white powder that is not at all unpleasant to use.

Milky disease is caused by a tiny organism, which has been named *Bacillus popilliae*. When a grub is infected with this disease the bacteria multiply rapidly in its body, and death comes rapidly. The blood of the diseased grub takes on a milky color and consistency, giving the grub a milky white appearance. It may be difficult, however, for the average gardener to distinguish the

Reprinted by permission from New Jersey Farm and Garden, April, 1944, Sea Isle City, N. J.

marks of the disease from the fat accumulation that is present in mature grubs. After an infected beetle grub dies it liberates three to nine billion more of the living spores of milky disease in the soil and thus establishes another fatal focus of the disease to infect succeeding generations of grubs for many years to come.

The milky disease organisms are remarkably resistant to dryness or excess moisture, and they are not harmed by high or low temperatures. Even bacteria that have passed through the digestive tracts of birds and small animals that have eaten diseased grubs remain alive and are reintroduced into the soil.

The grubs of the Japanese beetle hatch from eggs laid in the soil by the adult beetle. The grubs live in the soil for about ten months and feed on the grass roots in the lawn and other turf areas. These grubs pupate and emerge from the soil as adult beetles sometime in June. Consequently, the spring of the year is a good time in which to treat your lawn and garden with milky disease spore dust. To kill the grubs is to prevent the development of the adult beetles, and it also means the saving of your lawn from grub damage. Summer and fall treatments are also recommended. One treatment is normally sufficient—it will be effective for years, and it may never be necessary to treat your soil again.

The spores of milky disease are obtained from the blood of diseased Japanese beetle grubs. Films of the dried blood are put on glass microscopic slides for stock cultures. Tests have shown these spores to be still fit for use four years after storage. The spores in this dried blood are used to inoculate healthy grubs. An exact inoculating dosage must be injected into each grub by means of a hypodermic syringe.

The injected grubs then undergo a period of incubation. During this period they are kept in boxes filled with soil and a small quantity of grass seed. As the grass seed germinates, the sprouts supply food for the grubs.

After a period of incubation, the grubs are carefully screened from the soil, and then washed to remove all soil particles. They are then crushed by being put through a meat chopper.

A standardized grub suspension is then prepared and added to the carrier (calcium carbonate, precipitated, U.S.P.) to produce a mixture that contains one billion spores per gram of dry material. After thorough drying this concentrate is mixed with a dry carrier (talcum powder). The final mixture contains 100 million spores per gram, and it is ready for use by garden owners.

Stimulating Production

Condensed from The Jersey Bulletin

Prof. H. A. Herman
University of Missouri

THE effect of thyroxine on body metabolism has long been recognized. The effect of thyroxine on milk production and fat test was probably first established by Graham (1934), who observed that the addition of desiccated thyroid gland to the diet of thyroidectomized or normal cows in the declining phases of lactation resulted in a rise in milk yield and in the fat percentage. Further investigations on this subject by Jack and Bechdel of Pennsylvania (1935), Folley and White in England (1939), and Herman, Graham and Turner of Missouri (1937, 1938) proved that milk production could be increased from 10 to 22 per cent and the percentage of fat as well as fat yield could be increased as much as 37 per cent. Later experiments at the New Jersey, Mississippi and Missouri Stations have further corroborated this work, and in some cases report milk yield increases as high as 38 per cent and as much as 60 per cent increases in fat production.

Thyroxine and desiccated thyroid gland are very expensive, but in 1939-40 Drs. Turner and Reineke at the Missouri Station developed a material of great thyroid potency by iodinating milk casein. This preparation has undergone further improvement and has been found capable of stimulating milk and fat production in dairy cattle. In feeding trials with dairy cattle during the declining stages of lactation an increase of 18.6 per cent in milk yield was secured and the fat yield rose precipitously—as much as 53 per cent in one case.

This thyroidal substance or synthetic thyroprotein was first called *thyrolactin,* then *thyroprotein,* and is now labelled *protamone* for trade purposes. It has been patented and is now being manufactured by the Cerophyl Laboratories of Kansas City. Mo. The daily dosage (depending upon potency) is 1.5 to 2.5 grams per 100 lbs. liveweight for a cow. This compound may be easily incorporated into the grain feed. Further experiments are being conducted with protamone at 15 Experiment Stations as well as in a number of the larger feed companies. The commercial sale of

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this material is awaiting action of the U. S. Food and Drug Administration.

The advantages of this material are that (a) it is a cheap source of thyroidal activity; (b) a product of uniform potency when prepared under standard conditions; and (c) a material which may be incorporated into the ration.

Recognizing the problems that the use of thyroxine, or desiccated thyroid gland, could introduce into the supervision of cows on official test, the American Dairy Science association in 1937 adopted the following rule as a part of the Uniform Rules for the Conduct of Official Tests—including Herd Improvement Registry:

"Use of Thyroxine or Thyroid Extracts—The feeding or injection of thyroid extract or thyroxine to cows on official test is prohibited and evidence of its use shall be cause for cancellation of such records."

This rule has been adopted generally by all breed associations and is now in effect. Whether or not it will fit the picture in future years remains to be seen.

These pertinent items may well be considered at this time:

1. If synthetic thyroprotein (protamone) should be incorporated, as seems likely, in dairy and poultry rations, it will be difficult to detect.

2. The use of thyroprotein as a part of the ration under year-round feeding conditions has not been fully investigated. Cows vary in their response. The effect of high temperatures and the response from cows at peak production levels have not been fully determined. Overdoses and excess metabolic rates are harmful and will lower production.

3. It would be highly objectionable from the standpoint of sire proving to have the records influenced by such materials. Certainly, if the use of thyroprotein for cows on test is permitted, the fact should be so stated and made known to the public.

4. It would seem desirable to permit the present rule regarding the use of thyroxine and thyroid extracts to stand for the moment, but to be on the alert to modify and strengthen this rule as developments in the field warrant.

(The above is from an address by Prof. Herman, chairman of the breeds' relation committee of the American Dairy Science Association, delivered before the recent Cleveland convention of the Pure Bred Dairy Cattle Association.)

Your Corn-Borer Battle

Condensed from Successful Farming

James S. Ayars

Illinois Natural History Survey

THE European corn borer is here to stay as long as corn sprouts from the soil. That idea must be accepted by the Cornbelt. But it need not be cause for panic. The Belt has learned to live with many another insect, and it can do the same with the borer if an intelligent, relentless fight is waged.

For nearly a quarter century, the European corn borer was nothing more than a dreaded name to most of the Cornbelt. Accidentally introduced from Europe, and first discovered in the United States near Boston in 1917, it had reached Ohio and Michigan by 1921 and Indiana by 1926.

Weather unfavorable to the borer caused a delay in the insect's westward sweep. Then in rapid succession it was discovered in Wisconsin (1937), Illinois (1939), Iowa and Missouri (1942), and Minnesota (1943). By the fall of 1944, the borer will infest about 90 percent of the corn land of the United States, predicts John H. Bigger, Associate Entomologist of the Illinois Natural History Survey, who has studied the insect for the past 15 years.

How will the borer affect the nine-billion-dollar corn crop of the United States, producer of about 75 percent of the total world output? In Europe, this insect is reported to have caused crop losses in some years of 25 to 50 percent. An infestation of eight or nine first-generation borers per plant, not at all unusual in individual Cornbelt fields, is estimated by Bigger to mean a crop reduction of 20 to 25 percent.

Time may disclose better methods of control, but at present principal reliance must rest on three homely and not very spectacular practices: (1) cleanup of crop residues, such as stalks, (2) delayed planting, and (3) use of resistant hybrids. No one of these measures alone is sufficient. All must be used together in a continuous, relentless control program.

A thoro cleanup of cornstalks reduces the number of overwintering borers. Shredding, ensiling, or feeding the crop residues in the barnlot is an effective method of killing borers.

Reprinted by permission from Successful Farming, Des Moines, Iowa

But the best means for most farmers consists of clean plowing, at least six inches deep. A 98 percent cover of corn plants results in a kill of 96 to 98 percent of the larvae. Many of the borers are killed underground, and others crawl to the surface where they are destroyed by weather, birds, or animals. The cleanup is both an individual and a community problem. Because borer moths are strong flyers, the farmer who does a good cleanup job benefits little if his neighbors leave stalks on top of the soil.

Corn-borer moths, very particular about the plants on which they deposit their eggs, prefer the most vigorous, fastest growing corn they can find—plants that have not quite arrived at the tasseling stage. The customary planting dates in most of the Cornbelt bring corn—or at least that planted on land of high fertility—to a stage of development very attractive to the moth at just the time she is ready to lay her eggs. State and Federal entomologists have discovered that by delaying planting 10 days to two weeks beyond the usual planting time in almost any given area they greatly inconvenience the corn-borer moth. They force her either to lay her eggs on a corn plant that gives poorer support to the young borers than one further along in its development, or to seek an entirely different kind of plant not so well suited to raising young.

Effectiveness of delayed planting appears to have been verified in east-central Illinois this past season. What advice and recommendations might have failed to accomplish, weather achieved. A wet spring forced corn growers to delay planting about 20 to 25 days. The number of over-wintering borers in this area was high. The number of moths emerging in June and laying eggs also was high. Commercial sweet corn in the area, further along in development than the field corn, suffered heavily, and some fields were a total loss. But instead of an anticipated loss of three to five percent for the field corn in the area, the loss was approximately only one percent.

Corn hybrids differ greatly in their relation to the borer. Some high-yielding hybrids suffer serious damage from borer attack. Others appear to be unattractive to the borer moths, or unsuitable as food for the larvae. Still others seem able to stand up and produce in spite of borer attack.

For many years before the borer spread as far west as Illinois, the United States Department of Agriculture maintained a laboratory at Toledo, Ohio, where controls for the borer were studied intensively. Here R. H. Patch of the U. S. Bureau of Entomology and Plant Quarantine tested

resistance of many hybrids to the borer as it existed in northern Ohio.

As the borer moved into Illinois, southern Ohio and parts of Indiana, it developed two generations per season instead of the one generation common in the Toledo area. Some of the hybrids that had stood up under attack of one generation in northern Ohio could not withstand the attack of the second generation. Altho the resistance of many strains is well established so far as the single-generation areas are concerned, much work remains to be done where the second generation occurs.

In addition to the cleanup of residues, delayed planting, and use of hybrids adapted to the area, the use of parasitic insects (small wasps and flies that live on the borers or the eggs and destroy them) should be considered a possible means of control in the Cornbelt. Illinois and Iowa have already launched an accelerated program of parasite liberation. The first large-scale introductions in Illinois are being made this spring, but even if the parasites can be successfully established in the Cornbelt, little can be expected from them for two years.

Tillage and Fertilization Below Plow Depth

Condensed from New Jersey Agriculture

C. H. Nissley

Extension Horticulturist, Vegetable Growing

THERE is always a cause for failure of a crop to grow normally, and it can usually be found by careful examination of the soil and of the condition and development of the plant roots. Through many examinations of vegetable-growing soils in New Jersey, the department of vegetable gardening of the Experiment Station discovered, as far back as 1935, that both the physical and the chemical condition of the soil below plow depth often have a marked effect on crop yields.

The presence of plowpans or plowsoles and of other compacted layers of soil, which hinder penetration of water and roots of crops, was discovered on many of the vegetable farms in New Jersey. The depth of these hard layers ranged from just below the plow line to 11 to 12 inches below the surface of the ground. On examination, both the surface soil and the subsoil (the word "subsoil" in this article refers to the soil just below plow depth) were found, in most cases, to be deficient in calcium and phosphorus, the subsoil being so acid that the crop roots were unable to develop in them.

Studies made in 1936 substantiated the findings of the previous year. General field observations showed that better than average plant growth and yields were obtained on back furrows through fields, or wherever exceptionally deep plowing had brought some of the subsoil to the surface. In the center of one field, where the removal of a tree had necessitated breaking through the hard layer, thus deepening the plowed soil, and on several plots where carrots and parsnips had been harvested with root-plows, which penetrated the soil to a depth of 12 or more inches, improvements in growth and yields also were noted.

In an effort to determine whether these observations bore any relation to the common experience of vegetable growers that crops following old asparagus plantings produced extraordinarily large yields, the soil of a number of asparagus fields was examined. No signs of a hard layer or plowsole could be found, the asparagus roots evidently

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having opened up the soil so that water and air could penetrate deeply. This evidence added weight to the contention that deep soil preparation is one of the important factors in obtaining large yields.

Early in the spring of 1937 two tests were started on asparagus: one on the farm of Ernest Brooks in Gloucester, and one on the farm of Charles Heilig in Cumberland County. After the rows had been furrowed out, some were left untreated prior to planting, and a number were treated with limestone, others with superphosphate, and still others with acre applications of 2,000 pounds of limestone and 1,000 pounds of superphosphate. The materials were put into the furrow, and were mixed into the hard layer beneath by using a subsoil plow in the bottom of the trench. Asparagus roots were then planted. In 1 year, the growth in the treated rows, irrespective of the materials applied, resembled that of a 3-year-old field, and the yields of these rows 2 years after planting were estimated as more than double those from the untreated rows.

Five tests similar to those on asparagus were made the same year on farms where tomatoes, eggplants, and other crops were grown; here, too, the treatments resulted in increased growth.

In 1938, four more asparagus planting demonstrations, and a number on market garden farms in northern New Jersey were established. In preparing for these demonstrations, it was found that the condition of the soil on many market garden farms in Passaic and Bergen Counties was considerably worse than that on general truck farms.

Equipment that would lessen the labor of preparing the soil, place lime and fertilizer at considerable depths, and do the job more efficiently was needed, and work on this phase of the problem was begun at once. A panbreaking attachment for the plow was developed to replace the subsoiling operation, and a fertilizer drill was fixed to the back of the plow. This combination implement plowed the ground, pulverized the subsoil to a depth of 5 to 9 inches below the furrow, and distributed a mixture of limestone and superphosphate or complete fertilizer over and into the freshly broken plowpan in the bottom of the furrow.

Meanwhile, work on the development of new equipment went on, and in 1939 a simpler combination machine, without a fertilizer hopper, was tested in 23 demonstrations. This model, instead of applying the limestone and fertilizer in the bottom of the furrow, plowed under the materials which had been broadcast. A panbreaker was attached to the

plow to loosen up the subsoil. Merely breaking up the sobsoil did not, in many instances, solve the problem; the improvement, however, was so great that on every farm where a demonstration was made, the grower continued the practice.

On those farms where something more than the physical condition of the soil appeared to be at fault, further study showed that the subsoil either was very deficient in both calcium and phosphorus or it contained salts that were harmful to the plant roots. Placing large amounts of lime and phosphoric acid on the surface did not always help to correct such conditions, for these materials do not penetrate readily. In such cases, lime and superphosphate had actually to be placed on and worked into the subsoil, lime being especially important for improvement of clayey subsoils.

The next problem, then, was how to get the lime and phosphorus into the subsoil. To accomplish this, a middlebreaker was equipped with a panbreaking attachment and a divided fertilizer hopper, which could apply lime and phosphate 3 to 8 inches below plow depth. This machine was used in 10 demonstrations established in 1940: 3 on sweet potatoes, 2 on sweet corn, 2 on market lima beans, and 3 on cannery tomatoes. Examinations during the growing season showed very clearly that the roots of all these crops concentrated around the band of the limestone and phosphate applied 12 to 14 inches under the row.

The sweet potato demonstrations provided the most striking results. Marked differences in yields were obtained from rows receiving the different treatments. In this demonstration, started May 22, 1940, limestone and 20 per cent superphosphate were applied to the entire field at the rate of 500 pounds of each per acre. The 750-foot rows were 36 inches apart and the plants were set at intervals of 18 inches in the row. Once planted, all rows received the same cultural treatments.

The potatoes were dug on October 22. Rows subsoiled and given an application of 500 pounds of superphosphate at plow depth yielded 317 bushels per acre. The yield of rows to which 500 pounds of dolomitic limestone was applied in the subsoil was at the rate of 329 bushels per acre. Rows treated with 500 pounds of super-phosphate at plow depth and 500 pounds of dolomitic limestone in the subsoil produced 353 bushels per acre. Rows subsoiled only, yielded 334 bushels. The yield of check rows not receiving any additional treatment was only 265 bushels.

By 1942, such great interest

had been aroused in the deep application of lime and fertilizers on vegetable-producing soils that a hopper was attached to the rear of an Oliver No. 2 subsoiler for the purpose of applying fertilizing materials to varying depths in the soil, and the following year 78 tests with this implement were made throughout New Jersey.

The results of the spring tests supported the conclusions of previous years that maximum vegetable yields demand healthy and adequate root systems, which can develop only under favorable soil conditions.

It is quite evident from the investigations made during the last 8 years that tillage and fertilization of the soil below plow depth may be of help in correcting certain faulty soil conditions. Just how much they will aid in solving the vegetable grower's soil problems is a question to which the Station hopes soon to have a more definite answer. To this end, extensive experiments throughout New Jersey are being planned for the coming season by the Station's research workers in soils and in vegetable gardening. That the treatments are beneficial on some vegetable farms in New Jersey, but are not necessary on all farms, is a known fact, and their probable value on any farm can be gauged by the chemical and physical condition of the soil.

One of the most practical methods of determining the density of the soil below plow depth is to observe carefully the rapidity of the disappearance of water after a heavy rain. If the subsoil is open, the water will soak downward and not stand on the surface of the ground for any length of time.

If such observation indicates that the soil is impervious to water, the cause should be determined by digging a hole and examining the different layers of soil. If a plowsole is found, the condition can be corrected by varying the depth of plowing from year to year or by using other means to break through the shallow hard layers.

Deep tillage will help to correct hard subsoil conditions by breaking up the soil as far below plow depth as is necessary. The advantages of deep soil preparation are many. By it, the rate of penetration of surface water into the subsoil is increased, and the soil is aerated to greater depth. The deep penetration of roots into the subsoil for moisture and plant nutrients thus is facilitated, and an area for root development, where soil temperatures do not change so rapidly as in the surface soil, is provided. Soil conditions that favor the development of a deep and extensive root system are conducive to uniform and luxuriant plant growth and hence to maximum vegetable yields.

Better Pastures Depend on Soil Fertility

Condensed from The Fertilizer Review

Dr. W. A. Albrecht

Chairman, Department of Soils, University of Missouri

THE increased demands for food under wartime labor shortages on the farm are bringing us face to face with the problem of the wisest management of our lands. The use of more pasture crops, and the more efficient use of lands already in pasture, suggest themselves as wise means of greater output of food with minimum labor. But many so-called "permanent" pastures go to weeds so extensively that much labor and machinery are demanded in mowing them. In addition, their animal-carrying capacity is often so low that their service in terms of food production scarcely warrants their consideration as significant war crop producers when in contrast a few tilled acres in other crops could be so much more effective in animal output.

But since Missouri—as is true of many other States—is already a grain-importing State, the arable acres should go for grain production. Consequently the grass and forage needs must be met by attention to those acreages already devoted to herbage crops. Shifting these acres out of pasture and into row crops is not good agricultural policy as the first World War told us. That their animal output per acre can be improved; that their labor costs in terms of the fight against weeds can be reduced; and that their season of grazing service can be extended—all by means of supplying some soil fertility—has not been widely recognized. The permanent timothy plots and the timothy crops in rotation on Sanborn Field, at the Missouri Experiment States, bear testimony that these are possibilities that can be realized.

Lands in pasture have seldom been given much help toward greater production by means of soil treatments such as limestone, phosphate, or other fertilizers. Pastures have been a kind of stepchild on the list of different crop uses of fields of the farm. They have usually been disregarded when manure was to be hauled out. Manure has been considered more valuable on lands going to grain crops. Data from Sanborn Field at Columbia, however, testify that manure used on the permanent timothy plots

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has given the highest returns per acre and per ton of manure applied on this old experimental field when it was put on the grass crop.

Where timothy has been the continuous crop now for more than 50 years, the annual application of six tons of manure has netted a ton and a quarter of hay as the increase. Where three tons of manure have been used on timothy following clover in a six-year rotation this barnyard fertilizer has also given a ton and a quarter of hay as its return. Where this light application of manure was combined with phosphate, this application of soil fertility has given just about a ton and a half of extra timothy hay as the return on the investment put into the soil for a common pasture crop. When pastures are the areas left over after acreages for intensified tillage are listed, and they can be put into intensified production of food via milk and meat through soil treatment, there is every reason to give thought to fertilizing the pastures now when fertilizer use pays so well and when food is needed so badly.

Much has been said about the need to mow pastures as a means of eliminating the weeds. It has been contended that cutting the weeds is necessary in order to keep them from going to seed and spreading their infestation. We have given a little thought to the fact that the incidence of weeds in a pasture is evidence of declining soil fertility, which if pushed up to a higher level by lime and other fertilizers, would grow grasses so well that weeds would find no place.

This fact is again well illustrated by the plots on Sanborn Field. On the continuous timothy plots where manure has been applied annually there are no weeds. It needs mowing only in making hay. It is a fine mat of densely-growing timothy plants. Where no fertility is returned and the timothy is left to maintain its pseudo-permanence through efforts wholly its own, there has been a gradually increasing incidence of weeds. After a period of about six to eight years in sod the land must be plowed and reseeded to this crop. This has been the behavior of this grass plot during 55 years of its history. It testifies that as a permanent grass plot there is permanence only in the adjoining plot where manure is returned as soil treatment. There is no permanence when left without attention to its fertility. When ample fertility grows a good grass crop there are no weeds to mow. Where the fertility is not returned weeds require mowing.

During this past year the timothy plot without manure demonstrated nicely how permanent

pastures like this one, neglected as to fertilizer treatments, shift over to become fields of broom sedge (*Andropogon virginicus*). It was eight years ago when these timothy plots were last plowed and reseeded as a means of maintaining them under the more nearly comparable crop conditions required in careful experimental studies. Weeds of various kinds have taken their prominence in the succession of them on the untreated plot. It was not until fall, however, after the weed collection had been cut for hay during the summer, that this plot became a complete stand of broom sedge. It was as late as November that this weed crop blossomed and set its seed crop. Broom sedge demonstrates its final and complete possession now as a perennial weed crop on this soil where many other weed crops have had their short stay and then passed out as the exhaustion of the available fertility starved them out. Here now mowing might seem necessary, but of what profit or service would it be?

That the infestation by broom sedge during this year was confined so thoroughly to this untreated permanent timothy plot, while all the other plots on the field were not taken by this weed suggests that the level of soil fertility is a factor in making the land susceptible to a particular weed infestation. Different weed crops represent their own different chemical compositions as the studies by A. W. Klemme demonstrate. As such, each weed crop demands delivery of soil fertility in different chemical combinations of kind and amount. Broom sedge as a crop suggests that it can find enough fertility in the soil after a series of other weeds have taken their share and then found themselves starved out. As the last to date in the succession here it made 3,700 pounds of vegetation per acre even after the summer cutting for hay. Apparently as a perennial crop with its root stock sending up new shoots each year, it could get a foothold only in this plot remaining long unplowed. It apparently cannot establish itself in the other plots of the field, all of which are in rotations and do not have periods of absence of plowing longer than three years.

In the six-year rotation where the timothy was the crop in 1943, the untreated plot was devoid of timothy. The treated plots had a good timothy crop. In place of the broom sedge, however, the weed that had taken the untreated plot completely as early as August was not broom sedge. It was tickle grass (*Aristida*). As an annual this weed crop made its entrance on this cultivated soil that had been reduced in its fertility through continued crop removal and with no soil treat-

ments as fertility return. On the uncultivated continuous timothy plot just across the roadway, however, the weed infestation was a perennial crop of broom sedge. Differences in the rotation and in the amount of plowing brought different weed crops to demonstrate difference in these infestations.

Exhaustion of the soil fertility to make the land susceptible to weed infestation is clearly pointed out by these two cases when all the other plots on the field were immune. There is little danger that the seeds from these weed crops will infest the rest of the field, when surely the seeds that infested these susceptible plots last year fell likewise on all the other plots but failed to grow up as weeds. Mowing of these weedy plots now in order to eliminate the danger of infesting the rest of the field is thus unnecessary, when it has already been demonstrated that the other plots grow other crops so completely that these weeds find no place in the keen competition for the nutrients of the soil.

Higher levels of soil fertility, brought on and maintained by the use of manure and fertilizer, are thus demonstrating that they give larger yields of the desirable crops to which the fields are planted. In addition, the soil treatment eliminates the weeds and saves the trouble and expense of mowing them. It controls the weeds, not by fighting them, but by better nourishment of the paying crops that eliminate them. In terms of labor saved by eliminating weeds, soil treatments are good economy.

Dairy farmers, in particular, have often reported the pronounced economics that could be effected by extending the fall-grazing season by only one month. This extension is considered so significant because it eliminates one month of wholly-barn feeding. Little has been said for the possibilities in the much better feeding value of the green feed that is rich in hidden values. One extra month on such a feed may be extremely significant as a reducer of the time period on dry feeds when disease incidence is high, and the reproductive load is approaching its peak.

Soil treatments on Sanborn Field demonstrated again this past year that increased soil fertility prolongs the growing period of the grass crop and thus extends the grazing season. Timothy plots given manure, given less manure and limestone, and given manure, limestone and superphosphate were still green in late November. Extended growth of the crop by giving it some soil fertility by which it can keep on growing suggests that we have possibly been labeling the crops as "short-seasoned" when in real-

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ity they have been merely starved by poor soils. A small amount of limestone, phosphate or other fertilizer to keep a crop growing longer appears as a simple method of extending the grazing season.

In shifting to pasture crops there is the serious danger that we shall let increased woodiness and lower feeding value of the forages creep in unnoticed. Grain crops record the declining soil fertility by lowered yields of grain per acre. Grains are more nearly of constant chemical composition. Hence if the soil is too poor to provide generously the nutrients going into the grain, there simply is less grain. Forages measured as tons per acre do not reflect differences in soil fertility so accurately. Plants on soil too poor to make seeds still make tons of forage. But such forage that wouldn't make seed can't deliver for animal sustenance many of the nourishments that go from the forage to the seed in its formation and serve in the nutrition of animals.

As the fertility of the soil declines, there come into the pasture those crops which the animals refuse to eat and which we commonly call weeds. Animal choice testifies to the plant's chemical composition. Broom sedge is not taken by cattle. Sedge still makes tons per acre. So does tickle grass. But the disregard of them by the animals testifies that it is not the tonnage that serves in making meat. Mowing the weeds to eliminate them brings no change in the fertility within the soil.

As the fertility declines there is a change in composition within the same crop. As the soil delivers less of nitrogen, phosphorus, calcium and other plant nutrients then the crop is made more of carbon, hydrogen, and oxygen, or of air and water that make for woodiness. It is not so much an increase in woodiness as a decrease in what the plant manufactures inside of its woody structure. It is these different substances synthesized within the plants that are particularly nutritious. It is these that can be lacking even when tonnage harvest seem ample. This is the phase that may be the deception in our going to more forage crops unless we provide extra soil fertility.

Meat production is first a growth performance and later a fattening process. Growth is a matter of getting from the plants about a dozen chemical elements that the plant must first get from the soil. Fattening depends on the delivery of carbon, hydrogen and oxygen, coming from the air and water. But fattening cannot occur unless soil-given nutrients first make the growth of body frame. For growth and reproduc-

tion of the animals, soil treatments are of distinct value. The effects of lime and phosphate on the soil as they reach through the crops to the animals have been demonstrated recently. Lespedeza hay grown in 1941 on soil given phosphate only was 30 per cent more efficient, and that given both lime and phosphate was 67 per cent more efficient in promoting lamb gains than lespedeza hay grown without these fertility applications. Potency of males as breeders is also connected with the fertility of the soil. All of these effects add up to make pastures more efficient, and not hazardous, if we will see that the plants are fed with fertilizers before we can expect the pastures to feed the livestock.

Pastures like all other fields cannot be disregarded with reference to measures and other fertilizers and yet cropped continually without loss in their yielding power. The soil is dynamic. It is delivering elements of fertility that serve in plant growth and likewise in animal growth. This delivery is not perpetual. It is dwindling and with its decreased offerings have come changes in the kinds and qualities of the pasture plants. The incidence of weeds and the refusal of the animals to eat them have been the dumb beasts' plea for our attention to the soils. They have been calling for some help toward their better growth and more efficient reproduction by means of limestone, phosphate and other fertilizers as soil treatments. War necessities, priorities, labor shortages, and other impositions are bringing us to realize that grasses are no escape from diligent farming that is based on fertile soils.

Farming has higher earning power on the investment as the yields per acre go up. These go up as the soil has more fertility from which they are synthesized. Limestone and other fertilizers should be added to the pasture soils just as to soils in other crops. Such treatments will improve the tonnage of grass crops per acre with no increased cost of harvest by the animals that do so as pay for the privilege with more animal gain.

Soil treatments lessen the costs of attention to weeds by eliminating them; they extend the grazing season well into the fall; and they shift the composition of the herbage toward improvement in animal health, nutrition, and more animal gain per acre. Pasture grasses can be pushed up most effectively and the animal harvest therefrom increased by the soil treatments. As a war help, pastures are an unusual opportunity for war food production. But for its realization we must look to the fertility of the soil.

Mow Curing Takes the Weatherman Out of the Hay Field

Condensed from The Ohio Farmer

HOW would you like to cut your hay in the morning, haul it to the mow the same day, then have it come out of storage next winter bright and green, with the leaves still intact? That is the kind of results Ohio State University is getting by curing hay in the mow with unheated air forced thru flues with a fan.

At the Ohio Experiment Station last summer, the morning of July 27 was partly cloudy with high humidity. Mowing of a field of alfalfa was started at 7.15 a. m. while the alfalfa was wet with dew. Two hours later the side-delivery rake was started, making light windrows of the alfalfa which had dried only from 76 percent to 72 percent moisture.

By 2.30 in the afternoon this windrowed alfalfa had dried to 52 percent moisture but still felt almost as wet as when mowed. But loading was started and the driest hay to go into the mow that afternoon had 45 percent moisture in it. Stored in the flue-equipped mow, the fan was used as needed and in three weeks this hay had been cured to a nice green color, with the leaves still intact. Similar favorable results have been secured in several other barns where the system has been tried. Hay on a neighboring farm cut the same day was in the field most of the following three weeks and was almost a total loss.

No complicated equipment is necessary to dry hay with forced ventilation. All that is needed is a fan that will deliver a rather large volume of air under slight pressure, a motor, a main tunnel to carry the air from the fan thru the mow, and a series of small lateral flues to distribute the circulating air over the entire mow.

Even for a good-sized barn, a five-horsepower electric motor will provide sufficient power. In some cases, large used fans, such as are built for ventilating buildings may be available. Wallboard or some other composition material is commonly used for the main air tunnel. A farmer may use almost any type of rough lumber to construct the lateral flues that are placed along the floor of the mow.

These lateral flues, which are

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necessary to get the moving air distributed thruout the hay, are commonly spaced five to six feet apart and are constructed in sections, each smaller than the preceding one, so they will telescope.

Operation of the drying system is simple. The hay is placed in the mow and the fan run as needed until drying is completed. The drying process progresses upwards from the flues and the moving air is cooled until it is almost saturated with moisture. Thus, the hay does not heat, but instead the temperature inside the mow will usually be lower than that outside. The fan is not operated at all times, but may be stopped in hot, moist weather and run instead at night when the outside temperature is lower.

Just how efficient is this method is indicated when we consider that dry hay will have 20 percent or less of moisture, but that some shattering of leaves starts when a point below 30 percent is reached. Under this flue-curing method, hauling to the barn should take place when the moisture content is between 30 and 45 percent, otherwise it is not possible to get many loads in before shattering starts.

Scientist with His Feet in the Topsoil

Condensed from Nation's Business

Herbert Corey

HUGH HAMMOND BENNETT is the foremost soil conservationist in the world. So say other soil scientists.

Dr. Bennett is one of the devoted public servants who hold the Government of the United States together. There are scores of such useful men in our huge administrative establishment. Mostly they do not get into the newspapers. They just work. He does his paper work because it is a necessary adjunct to his work in the "dirt." His men in the Soil Conservation Service follow his plan. They tell the farmers what should be done. Then they get out in the fields and do it. They build terraces and stock-water ponds and plant trees. Dr. Bennett has put 100 hitherto unknown grasses at work nailing down loose topsoil. He does not spend the Government's money on the farmers. They do their work themselves. The more they do that work the more they want to do.

In the midst of this war China asked him to send a man to show the peasants how to farm better. Dr. Bennett has visited most of the South and Central American countries. Thirteen have sent young soil scientists to study under him. They pay their own way. One or two have been given jobs. They earn their money. When this war is over it is probable that some of Bennett's men will visit the desolated countries of Europe, because almost every country has soil conservation problems.

"Does it pay? Does it put more money in the farmer's jeans?"

It pays in millions. Remember that it costs nothing, except for administrative expenses.

"On 200,000 farms the increase in income has ranged from $2,500 to $3,000 as a result of the Soil Conservation Service's work."

That seems incredible. But remember that those farms were almost out of production because of soil erosion and its attendant evils. The farmers have kept books. On some farms the increases have run from $7,000 to the top report of $15,000. One had been practically washed away. No income to speak of in 1936. Gross average annual income, beginning with 1937, was

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$3,750. The $15,000 farm had grossed only $2,160 in 1936. In 47 states, 9,244 farmers reported an average annual increase in the income from the major crops from conservation alone of 33 per cent.

"Conservation," said Dr. Bennett, "will add at least one-fifth to our farm income. It means that 1,000,000 farms may be added to our productive area. Where there were five producing farms there will be six. The acreage was reduced by 13 per cent in one corn area and 1,380,000 more bushels of corn were harvested."

And not a penny was put up by the taxpayer. Except, of course, for administration.

The story of a town should be told as a preface to the Bennett biography.

Once there were five stores in the town. There were also two lodge halls, two automobile repair shops, two churches, a small hotel with a rocking chair gallery, and a Hat Shoppe. On a floor plows and harrows and mowing machines were on display.

Nowadays the few dollars spent in that town go through a single store. It offers a line ranging from harrow teeth to brassieres. In another little building the postmaster carries dusty cigars, soft drinks and hot dogs as sidelines. Almost any residence could be bought for the cost of the nails.

Multiply that haggard little town by no one knows how many similar little towns and guess at the loss to American business.

This particular little town was ruined because the farming land had been washed away. The forest had been cut over. The flood swept over the fields.

In what was once known as the Dust Bowl there were many little dried-up towns. The topsoil of the farms had been blown away.

Men and women desert such towns. They go on the road as okies. They drift into cities, looking for jobs. Workers in distant factories lose their time because a market has been impaired.

But, if erosion were stopped, hundreds of small towns would pick up again.

And Dr. Bennett believes that the land now being wasted will be needed.

There are no longer any new areas which may be brought into production. We must have larger crops. Vegetable oils may be called in to take the place of mineral oils; or to serve industry better. The makers of plastic gadgets may call on the farmer. Alcohol distilled from the waste products of the farm is already being used with gasoline in heavy duty motors. There is no end to the possibilities he sees.

He is certain that 20 per cent can be added to our arable land by stopping the run-off and get-

ting a part of the land back to something like its original condition. Some of it is done for. Perhaps 100,000,000 acres have been so washed out and dried and gullied that it can never be used except for pasturage and forest. Farm after farm is beset nowadays with gullies as much as 150 feet deep. Not even goats could live on them. Another 100,000,000 acres have been reduced in productive capacity but can be saved in whole or in part. This leaves only 460,000,000 acres of cultivable land and much of it is being washed away each season.

Bennett knows this land can be saved. He knows the hurt acres can be helped. He has been doing it for years.

He became a crusader because of eight words his father once spoke.

Bennett was born in the Lick Skillet section of North Carolina. The farmers themselves gave it that name. It is an example of the sardonic humor that has always plagued Americans. Perhaps if we had not been so willing to grin at our troubles we would have cured them.

The Lick Skillet farms had once been fertile and the farmers prosperous. We had so much money in those days that no farmer ever bothered to save an acre. The forests were slashed and the topsoil washed away. The grandfathers had loped to the county towns on thoroughbred horses. The grandsons were lucky to own mules.

The Bennetts had been good farmers and the Bennett farm was a paying concern. There was no mortgage on it. William Osborne Bennett had been able to give each of his nine children an opportunity to go to college. He had planned to be a doctor but he fought through the Civil War and that ended that dream. When the future soil conservationist was seven years old he tagged one day at his father's heels. The older Bennett was working thru his fields with a spade.

"What are you doing that for?" asked the boy. "Making all those little dams."

"To keep the good earth from washing away."

He learned from his father a reverence for and a love of "dirt." There is a virtue in it. He must get away from his desk now and then and plant his feet in it. Men who live on the soil have something in common. The Venezuelan Government sent for him to teach its Indians how to save their soil. Some of them were getting only three bushels of corn to the acre. Bennett found them sullen and blank-faced. They had been hungry all their lives. He "talks the worst Spanish you ever listened to—"

But he got into the dirt with his own hands and they were re-

sponsive. A current of understanding was set up. American farmers react in the same way. They do not take kindly to lectures by learned men, but when another farmer comes along and says this is how it goes they listen. A rancher in Wyoming told Bennett that he and his men were definitely batty. Then they showed him that they knew more about his farm than he did. Presently he was a convert. Then he became an evangelist and brought in other farmers. One thing Bennett always tells them:

"It is easier to farm better than to slight the job."

He often works with homemade tools. Like every enthusiast he would prefer the best. But a suggestion that a farmer spend a lot of money on a program in which he has little belief is likely to be met with blank stares. In Venezuela he explained to the Indians that the land should be terraced to save it from being washed away. They understood. Their ancestors had terraced some of the land. But they had no tools or instruments.

Bennett partly filled a beer bottle with water and corked it. A bubble found the bottle's middle when held level. So the Indians had a spirit level. There were blacksmiths who were able to produce tools from the odds and ends of metal that had been rusting in corners.

He was a bit late in graduating from the University of North Carolina. He had been obliged to pause for two years to earn enough money to go on again. He was ready to graduate as a chemist—specializing in soils—when Civil Service offered him a job to classify land. He did not wait to take his examination. In 1903, when he was 22, he was rated as a soil scientist in the soil survey then being conducted by the Department of Agriculture. In 1909 he was a member of the agricultural expedition to the Canal Zone. Twenty-nine years old. In 1914 he was in charge of the explorative expedition to find Alaska's farming possibilities. Thirty-four years old. In 1918 he broke out to go to war as lieutenant of Engineers. Thereafter expedition and commission followed in routine, to various Central and South American countries. In 1933 he was the director of the soil erosion service of the Interior Department, and he has been chief of the Soil Conservation Service of the Department of Agriculture since 1935. In between and coincidental with services on many commissions he managed to turn out authoritative books and articles.

His statement that, for the first 25 of his 40 years of soil saving, "no one paid any attention to me" might be taken with a dash of salt. He had the support of his

superior officers in the Government and of other scientists. It took the farmers some time "to wake up" but in the end many of them did. There is a power of propaganda in a bank book. He proved that washed out land—"land that wouldn't sprout a white bean"—could often be brought back to production. Better land could be improved. The farmer who ploughed around a hillock instead of straight up and down not only did so at less cost but saved his land and made better crops.

One thing that helped to convince his audience is that he is hard to lick. Sometimes he was unable to stop erosion in light soils by any known method. So he planted weed seed and the washing stopped. The first year the farmers laughed. The second year they scratched their heads. After that they were Bennett's men.

The gramma grass of the Southwest was one of the best natural grazing grasses but it had been dried out and grazed out. Its seeds are so tiny that no one had harvested them successfully. He put a modified carpet sweeper at work to get the seed. Now thousands of acres keep sheep and cattle fat.

His men map sections from planes. Each farm is a separate problem but each must be treated in its relationship to the whole.

Therefore in the twenty-fifth year of his service the Soil Erosion Service came into being. The farmers seem to like it.

"We don't give 'em a cent for anything."

Dr. Bennett is so close to his "dirt" that he knows how farmers think. They all want to improve their methods and their profits. But they do not like to be bossed. They detest detail and questionnaires and paperwork. They are essentially neighborhood bodies. If Neighbor Jones tries a new scheme Smith and Brown watch him across the line fences. Jones began to throw little dams across gullies to hold back the flood water, just as William Osborne Bennett had done before his son's eyes more than 50 years ago.

They cost the farmer nothing but time. More than 100,000 have been built, and only four-tenths of one per cent have washed away.

Bennett introduced kudzu to them. It was once considered a purely ornamental vine and was trained over porches. It not only nails down loose soil but it grows like mad and is a better cattle food than alfalfa.

He ran into a snarl in his dealings with the Navajos, who had grazed their sheep pasturages down to bare clay. Arithmetic meant nothing to them. But it developed they were able to count

up to 25. So he dealt with them on that basis. They are doing pretty well. Now they are fencing across the trails so that the sheep herds are diverted on their nightly march to the waterholes and the newly set gramma gets a chance to take root.

During the First War, farmers, tempted by high prices, ploughed up 30,000,000 acres that should have been left in grass. During the Second War they have ploughed only 1,000,000 acres. They want to hold on to their farms.

Forty-five states have now enacted laws under which farmers may if they wish—set up Soil Conservation Districts. The holdouts are Connecticut, New Hampshire and Masachusetts. There are now nearly 1,000 such districts. The 45 states comprise 99 per cent of the farm land of the United States. Once a district is set up, all the farmers in its boundaries must co-operate or the enterprise might fail. At the outset the conservation-minded farmers were sometimes able to create a district by the barest majorities. In one of the recent referendums the vote was 768 to one. Bennett's Soil Conservation Service provides the expert guidance but the farmers do the work. Books are kept by 15,000 farmers and reports made to the S. C. S.

"Sometimes we give them seedling trees or lend them machinery left over when the WPA went to pieces. And that's all we give them."

Dr. Bennett has bought back the old Bennett farm in what used to be the Lick Skillet neighborhood.

"I hope to live long enough to cut for the market some of the 38,000 seedling trees I planted. The old farm was washing away."

Not many things happen overnight. But when Bennett's hoped-for 20 per cent is added to the farm production of today it will be a great thing for the small towns.

Horseback Seeding

Joe J. Crow puts a burlap bonnet on his saddle horse to keep seeds out of its ears and climbs astride with a hand-operated whirling seeder to establish lespedeza in his native-grass pastures in Osage county, Oklahoma. He went over all thin spots in native grass pasture that way, and has lespedeza established wherever there is room for it.

—*Capper's Farmer*

Improvement of Soil Structure

Condensed from California Cultivator

R. E. Stephenson

STRUCTURE deals primarily with the open spaces in the soil. Good structure means an adequate number of large openings to allow water to infiltrate quickly and the excess to drain away readily, thereby assuring good aeration and the beneficial oxidation processes. Good soil structure permits easy root penetration and profuse branching with many feeding roots and root hairs that are the perfect absorbing system to sustain a well nourished plant; in fact, good structure is said to be the key to a productive soil.

Jacot states that the soil fauna (all the animals large or small living in the soil) is the chief structure-developing agency. Of first importance are those animals that make tunnels through the soil including earthworms, ants, beetles, millipedes and others. Many small animals do not make channels but do occupy them and keep them open as runways. When the tunnelers are destroyed as by floods, the soil becomes soggy and the crops languish until the soil life is again restored.

The animal life not only tunnels but also granulates the soil. The granular topsoil under rotting compost and litter is chiefly worm casts, and arthropod feces. The partially digested soil and organic matter is left in masses of little pellets that are perfection in granulation. Probably no medium, natural or synthetic, is superior to this type of material for supporting vigorous plant growth.

Roots of plants that penerate the soil produce effective structural openings. When the plant dies, fungi attack and soften the tissue of the root. Tiny insects then eat away the softened tissue leaving an open channel partially lined and fertilized with their feces. This effect may extend several inches or several feet into the soil according to the type of plant produced. Clovers and other plants with large, deeply-penetrating root systems are superior for soil structure development.

Bacteria which are so small that several million may inhabit half a thimbleful of good soil are also structure-forming agents. The bacteria produce a mucus which helps bind the smallest particles of soil into stable gran-

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ules. Bacteria are most abundant in the best soils that are well supplied with humus materials. Poor soils that are limed and manured will show a great increase in bacterial activity and an improvement in soil structure.

Nature works constructively again to create a mellow soil structure in the alternate wetting and drying of the surface layers. Clods shrink when they are dry and expand when wet. The hardest dry clod, too hard to break except with a hammer, will crumble into granules in short order if dropped into a pail of water. In the field, the rains slowly bring about the same effect, otherwise the huge blocks of soil sometimes turned over in tillage would probably never become pulverized.

Alternate freezing and thawing in cold climate shatters the soil into granules. Water expands nearly 10 per cent when it turns to ice thereby loosening and opening the soil. Farmers sometimes remark that they can tell what the previous winter was like by the way the soil works, another way in which weather affects farm operations.

Good soil structure, best described as sponge-like, is therefore almost entirely the work of nature. Man-made soil structure by tillage operations is short lived, and affects only a few inches of topsoil. Nature may produce several feet of open, porous soil. Man must work with nature and not against her to keep the soil good, through the production of soil-building, sod crops, with deep root systems. Nature puts plant residues into the soil, but man sometimes does his best to keep plant materials out of the soil, thereby thwarting nature's purpose of soil improvement, and when the soil has been nearly ruined by man-made operations, only nature aided by man, if he is wise enough to understand her methods, can again restore the land to fruitfulness.

Thinning Apples at Blossom Time with a Caustic Spray

Condensed from American Agriculturist

M. B. Hoffman

New York State College of Agriculture

SOME varieties of apple set a heavy crop of fruit one year and remain practically barren the following year. This habit is called "alternate bearing" or "biennial bearing". During the "on year" when there is a heavy crop of fruit, there is likely to be an excessive number of fruits. This large number of fruits per unit of leaf area usually results in small size, poor color, and often in a reduction of quality.

Scientific study has shown that the only way these varieties can be induced to bear fruit more or less regularly, is to thin off the excess flowers at blossom time. That is of course wholly impractical because of the tremendous amount of labor that would be involved in removing these flowers by hand.

Recent investigations have shown the possibility of removing some of these excess flowers by use of a caustic spray. This treatment not only encourages annual production but it also eliminates the necessity of much hand thinning during the crop year. With the present acute labor shortage and high price of inexperienced help, many growers are finding it difficult to do a satisfactory job of hand thinning during the summer. This new development seems to be a promising approach to the problem of annual production of good quality apples.

Different results will be obtained with different varieties. The work to date indicates that the practice holds the most promise for such heavy setting varieties as Yellow Transparent, Early McIntosh, Duchess, Wealthy, Baldwin, and perhaps Golden Delicious and Rome Beauty. Some growers have reported encouraging results with Jonathan, Stark and Wagener. Tests should be limited to these varieties until more is known about the response of other sorts. The spray should not be used on very weak trees of any variety or those not fertilized with nitrogen in previous years.

Sodium dinotro-cresylate has been used as the spray material in most of the experimental work with bloom sprays. A concentra-

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tion of one pint of this material per 100 gallons of water is a general basic concentration from which varieties can be made in both the lower and upper directions dependent upon the variety and vigor of the trees. It will probably require a quart per 100 gallons to thin Duchess sufficiently, as well as very vigorous trees of Yellow Transparent, Early McIntosh, Wealthy, and Baldwin. One and one-half pints per 100 gallons has resulted in satisfactory thinning of Wealthy trees of moderate vigor. In one case a concentration of ¾ pints per 100 gallons proved adequate for Rome Beauty and Golden Delicious. Unquestionably vigor has much to do with the results and should govern the concentration.

The most satisfactory degree of thinning has been obtained by making the application just as the tree reaches a stage of approximately full bloom, or at that time when 95 to 100 per cent of the lateral spur flowers have opened. The spray will destroy freshly opened flowers but permits fruit setting by the older center flowers of the spur which opened a day or more before the lateral flowers. Delaying the spray for a full day or more following the opening of the lateral spur flowers will usually result in insufficient thinning. For any given variety there will seldom be more than one day when enough of the flowers are in the proper stage for spraying to accomplish a satisfactory thinning with the dilutions suggested.

The spray material as obtained is a super-saturated solution in one gallon cans. For this reason most of the active ingredient has settled to the bottom of the container. It is highly important to stir the contents of the can thoroughly so that the fraction taken is entirely representative of the contents of the original container. It will be found more convenient and accurate to make a stock solution by mixing one gallon of the concentrated spray in 9 gallons of water. Ten pints of this stock solution will then be exactly equivalent to one pint of the concentrate.

The spraying should be thorough enough to cover every flower. Applied at the right time, it will not prevent fruit setting by the center flowers of the more vigorous spurs but all lateral flowers must be hit to destroy them. One of the most common mistakes made by a person using the spray the first time is the tendency to spray very lightly. There seems to be a fear of killing all flowers. If the trees are of the right kind to receive the treatment, they will stand thorough spraying and this will be needed for sufficient thinning. Spraying from the tank has proved quite satisfactory.

Where mature trees are begin-

ning to crowd in the orchard, the low limbs are, of course, less vigorous than those in the upper two thirds of the tree. Uniform spraying of closely planted trees is likely to thin the crop too severely on the low limbs. This has been experienced in closely planted orchards of both Wealthy and Rome Beauty. Under such circumstances it will be the safer practice to ride the rig and spray the top two thirds normally and skimp on the low limbs which can be hand thinned later if they need it.

The young spur leaves present at the time of application will be injured somewhat by this spray. This should be expected; and, under certain weather conditions it may appear quite serious. However, the injury to these first spur leaves, which always remain small in size, does not seem to be harmful to the tree. If the spray is correctly timed so that sufficient flower thinning is accomplished, a vigorous leaf growth, that will contribute to the production of high quality fruit as well as annual bearing, follows within 2 or 3 weeks. When the spray is applied too late to reduce the set, new leaf growth is retarded by excessive fruit setting and the injured foliage may be apparent most of the summer. In such a case it would be considered that more harm than good was accomplished.

While considerable interest seems to have developed in the use of these so-called dinitro sprays for thinning, it should be remembered that the practice is still definitely in the experimental stage and is not recommended for general use. Some growers have tried the practice and where results were favorable, or not entirely unfavorable, they might feel that the job could be duplicated or even improved on a larger scale. If one has not had previous experience with this bloom spray for thinning it would seem best to limit trials to a few trees in order to develop the technique of timing and applying the spray, learn the best concentration for the trees and evaluate the results.

Simplified Control of Fowl Leukosis

Condensed from Farm Research

F. B. Hutt
Cornell University

BETWEEN 40 and 50 per cent of the currently high mortality in pullets during their first laying year is caused by paralysis, tumors, or other forms of what is sometimes called "the avian leukosis complex." Recent studies have shown that losses from this dreaded disease can be greatly reduced by the simple procedure of brooding the chicks at some distance from adult fowls *during the first two weeks after hatching.*

It had previously been known that complete isolation of the chicks during the entire rearing season provided effective protection against leukosis, but, for most poultrymen, the maintenance all summer of an entirely separate establishment for rearing is impracticable. The Cornell studies show not only that isolation for the first two weeks is remarkably effective, but also that a fairly satisfactory degree of isolation for that period can be provided right on the poultry farm, without setting up a separate brooder house a mile or so away.

These facts emerged from an analysis of several years' data cerning White Leghorns bred for resistance to leukosis. After they were 2 weeks old all of these birds had uniform environmental conditions on the rearing range and in the laying houses, but, in the first 2 weeks after hatching, half of them were brooded in one brooder room, F, and the other half, or alternate hatches throughout a 10-week hatching season, in another brooder room, B. Because both of these brooder rooms were within 110 feet of adult fowls, and because the attendant for each brooder room divided his time between the young chicks and the old hens, it was believed that in both F and B the chicks were getting a maximum exposure to the virus, or whatever it may be, that causes the disease. Such an exposure was necessary if the resistant and susceptible families were to be differentiated.

Analyses of the data revealed, however, that after the pullets were housed, at about 160 days of age, mortality was consistently higher (up to 500 days of age) in

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the ones that had started out in F than in the others. Moreover, in 1940, 1941, and 1942, deaths from leukosis in different strains and in different years were from 1.6 to 4 times as frequent in the F birds as in the others. In three different strains the mortality from leukosis for these 3 years was as follows (weighted averages):

	Birds from Room F	Birds from Room B
In C resistant strain	14%	5%
In K resistant strain ...	15%	6%
In susceptible strain	30%	16%

Since each of these 3-year averages represents from 700 to 1,600 birds, the differences are significant. Moreover, the data for 7 years were consistent. This means that, incredible though it may seem, the question whether these chicks would experience light or heavy losses from leukosis after they were 5 months of age was determined to a great extent during the first 2 weeks of their existence.

What was the difference between brooder rooms F and B? Both had almost identical brooding systems and were similar in other respects, except that F was located within 40 feet of nearby pens of adult fowls, while to reach B, the attendant had a walk (outdoors) of about 110 feet. The evidence indicates that the chicks closest to the adults got a more severe exposure to the disease than did those farther away.

The practical application of these findings is obvious. Losses from leukosis can be reduced by brooding the chicks for the first 2 weeks far from the adult fowls. Isolation for a longer period may be still better, but isolation for 2 weeks is highly effective. A separate brooding establishment a mile away is not feasible for most poultrymen, but it should be quite practicable for anyone to start the chicks in colony brooder houses in the orchard, or out in the pasture, or anywhere else so that the attendant does not step directly from the laying house to the brooder room. The long permanent brooder house is less desirable, unless isolated.

It should be noted in the figures given above that deaths from leukosis were more frequent among pullets of the susceptible strain that were lightly exposed than they were among pullets of the resistant strains that were heavily exposed. Clearly the extent of the losses encountered in a flock depends in part upon the degree of exposure to the causative agents, but also upon the degree of genetic resistance that has been established by careful breeding. The poultryman who pays attention to both will fare best.

Big Things Ahead in Quick-Freeze

Condensed from Farm Journal and Farmer's Wife

Ray Anderson

A LOT has been heard about quick-freeze, but the whole story hasn't been told. For the last several weeks I have been talking with folks who will make after-the-war equipment, with researchers studying how to keep the food, with leaders of farm co-ops who have big marketing plans, with farmers; with everybody, in a word, who could help draw the real picture of what quick-freeze will mean to farmers after the war ends.

It's a bright picture. It promises:

1. More dollars for many farmers by opening up new markets—they may sell important amounts of frozen produce. Freezing will give them another chance to be *processors*.

2. Changed food habits, better health.

3. Jobs for returning service men—and for older farm girls—some of these jobs right on the farm.

4. Temporary headaches for the whole food industry while adjustments are being made.

5. Lightening of the farm housewife's work. "Freezing takes less than half as much time as canning, and is much less fuss," says Miriam Williams, *Farm Journal's* Foods Editor. "Modern frozen food containers are so easy to handle, and all the long processing with heat is eliminated. Products can't help tasting fresher, for there is less chance for food to deteriorate or spoil when the time required to get them ready to freeze is so short. And no hot kitchen!" Frozen vegetables and meats cook in a very short time, too, as freezing seems to tenderize.

Manufacturers had a good start on designing farm freezers before the war, and have been planning improvements since. It appears now that five main types will predominate:

1. A relatively small cabinet of four to twelve cubic feet capacity, capable of freezing, but intended chiefly for storage at zero temperature. It probably will sell at $175 to $300, depending on size.

2. A larger box, 15 cubic feet or more, with one compartment for freezing and another for zero storage. This may sell around $350 to $400.

Reprinted by permission from Farm Research, April 1, 1944, Geneva, N. Y. Philadelphia, Penna.

3. A larger cabinet with three compartments at different temperatures, for chilling and aging meats and game, for freezing, and for storage. Price estimates are from $600 to $1200 and up.

4. A low temperature unit of six to eight cubic feet built in as part of a regular refrigerator. Cost, including refrigerator, may be from $180 up.

5. A "walk-in" type. This may be sold as a complete unit, or it may be an existing room in the basement or adjacent to the kitchen (maybe the old pantry) which has been insulated. In an insulated room just the temperature control machinery would be added. Lenore Sater, household equipment expert for the U.S.D.A., predicts that such rooms will soon be shown on the plans for new and remodelled houses.

The "walk-ins" will be mostly for ranches, plantations, or big farms with many persons to feed, or for farms selling quantities of frozen food. The "reach-in" types will have either top or side opening.

Prices just mentioned are tentative, of course. They may be approximately correct for the first outfits quoted after the war. No one knows what the costs of manufacture, the volume of sales, or the future improvements may eventually be. Operating costs will probably be not more than $2 a month.

Portable freezers for farms are less than five years old, and the war halted the industry when it was "still a-bornin'."

When will manufacture be resumed? Likely not on any large scale until the end of the war is plainly in sight. However, a midwestern company is now making a limited number of cabinets under a special permit. The War Production Board is considering whether to allow manufacture of 25,000 more. If it does, local AAA rationing committees may handle their distribution.

Cook, Then Freeze

What can you freeze? Well, the newest thing is frozen *cooked* foods. Some women find that since they have to blanch foods anyway, they might as well go on and cook them. They can save labor, too. They may, for instance, bake once in two weeks or a month. They could bake meals for threshers or silo fillers or for Sunday company ahead of time, and just put the cooked food in the freezer. On the Pacific coast one company has been selling ready-cooked frozen meals, complete even to the gravy.

Bread, pie, baked beans, stewed (and boned) chicken, are just a few things that can be cooked before freezing.

About the only vegetables that fail to freeze well are celery, lettuce and whole tomatoes. Tomato puree freezes beautifully.

So does a new sweet-potato puree, and purees of various fruits. A recipe has been worked out for an all-fruit *frozen* dessert. It has the texture of ice cream, but uses no dairy products. The Quartermaster Corps plans to supply the army with it. Freezing of fruits for a limited time, without pre-freezing preparation, prolongs the canning and marketing seasons.

The two big angles for farmers in the forthcoming expansion of quick-freeze are (1) new market possibilities, and (2) home convenience.

The *bulk* of frozen food sold in grocery stores will likely come from professional food processors, as at present. Certain companies are already well-established in the frozen fruit and vegetable market with high-quality products, and doubtless will maintain that position. There are 1400 packers in the United States, including those who don't slaughter. Their products compete successfully with locally-butchered meat, because packers make better use of by-products, and thus overcome their freight disadvantage. This is one reason why much of the meat going into locker plants now comes from packers, rather than direct from farmers.

Nevertheless, there are interesting market possibilities for farmers in quick-freeze:

Farm women have always found markets for specialties of high quality, "fresh from the farm." They have had phenomenal success with community markets. There are now approximately 250 of these women's markets in which 8,000 women sold nearly a million dollars' worth of produce last year, according to the U. S. Department of Agriculture.

If women can sell fresh and canned stuff there they will sell it frozen, too, just as soon as town and city housewives have sufficient refrigerators with necessary compartments for holding the food at zero temperature. Some of it will be sold by delivery to the customers' own homes, and at roadside stands.

I know of a farmer near Sycamore, Illinois, who sells practically all of his chickens frozen. It's a good business.

I know other farmers who now let half of their strawberry crop go to waste because the price is always low come picking time. Some day they will freeze those berries, and sell them later at a fair price.

One of the biggest groups of farmers' creameries in the country has post-war plans for adding kitchens to certain creameries, and selling not only dairy products but frozen meats, fruits and vegetables, cooked and raw, through the same marketing

channels as now used for butter and cheese.

In all of these enterprises, farmers not only get paid for *producing* food but for *processing* and *selling* it—the "Vertical Diversification" principle.

There are now more than 5200 locker plants, with 1,800,000 patrons, 1,400,000 of them farmers. That means that 23% of the nation's farm families are already accustomed to freezing food. It won't be too big a step for many of them to freeze some more for sale.

Quick-freeze right on the farm has the advantage over lockers that the food is right at hand when needed. However, this is not such an advantage for town people, and it may be that some of the lockers relinquished by farmers will be taken over by folks in town.

Another thing that will keep locker plants in business is the service they sell — butchering, wrapping, etc. — which so many farmers have learned to like and many depend upon entirely. (On the other hand, it's possible, of course, that someone will take these services out to the farm some day.)

The airplane offers interesting quick freeze possibilities. Planes may pick up fresh food in one part of the country and freeze it in sub-zero temperatures in the stratosphere while en route (or by mechanical means if flying lower).

This idea is not so fantastic. Much has been learned about saving space in ocean freight; the same will undoubtedly apply to the coming "flying box-cars."

Plane transportation of frozen foods would open up jobs for military pilots—many of them farm and country-town boys—when they return from the war. Many of the 300,000 army and navy men trained in meat cutting, by the National Livestock and Meat Board, will be needed in the expanding frozen food industry. And a demand factor not to be overlooked is that military men have learned to eat more fruit, vegetables, and meat, and will likely keep right on eating more when mustered out.

It certainly looks as if there are big things ahead in quick-freeze.

The Brood Sow and Litter

Condensed from Hog Breeder

E. L. Quaife
Iowa State College

SUCCESSFUL pork production depends, in a large measure upon the brood sows used and the methods employed in their feeding and management.

Selection of the Gilt

A desirable gilt for pork production possesses the following qualifications:

(1) Comes from a large, well-nourished, fast gaining litter.
(2) Clean cut about the face and trim in the ear and neat about the jowl. Deep body and a long underline showing five or six well-developed, clean-cut teats on each side of the belly.
(3) Broad of back, showing a well-sprung rib, wide in the loin, broad and deep in the ham. A body conformation which suggests easy feeding quality.

Gilts to become successful brood sows must be fed to develop size, length, bone, vigor and reserve strength. To accomplish this separate them at the age of 4 or 5 months from the fattening hogs. At this age the gilts need a growing ration rather than one made up of much corn. Either whole oats, self-fed, or a half and half mixture of oats and barley coarsely ground and self-fed make a good foundation for a ration. Hand feed corn in addition to maintain a fair degree of flesh and to keep the gilts gaining. Feed some protein supplement with this grain. One-half to ¾ gallon of skimmilk daily, about ¼ pound of tankage, or ⅓ pound of the trinity mixture (made up of 2 parts tankage, 1 part oilmeal and 1 part alfalfa meal) will furnish enough protein in addition to what they get from the grain and fall pasture. This protein feed may be hand-fed or mixed with the oats at the rate of 5 to 8 pounds to each 100 pounds of oats.

Access to a simple mineral mixture, and the range of a pasture or a field in which small grain or soybeans were grown, will be beneficial to the development of the necessary scale and bone.

A further stimulus, commonly known as "flushing," through the heavier feeding of both protein

Reprinted by permission from the Hog Breeder, April, 1944, Chicago, Ill.

and fattening feeds just prior to breeding helps bring the gilt into her heat period, and contributes toward the production of a large litter of pigs. Too much fat on the gilt at breeding time, however, may cause the production of small weak litters.

If the gilts have the "flu" about breeding time, trouble will be experienced in settling them. Some may settle while others will not, resulting in unevenness of litters. There is a strong probability that the litter from a gilt will be small and weak, unless she is restored to health before being bred. Following a case of the "flu" defer breeding until the second heat period. Old or tried sows are seldom affected with the "flu" because they either had the trouble as gilts, or are naturally immune to it. A practice which will avoid some of the trouble from "flu" with gilts would be to select the gilts to be kept for brood sows, from fall farrowed litters. The gilts are bred the following spring to farrow their first litters the next fall on pasture. These gilts are rebred to farrow the succeeding spring's pig crop and then sold. Such a practice permits the breeding of the gilts to farrow as early in the fall as may be desired. It also permits the use of tried sows on the farm in the fall and early winter when most trouble from "flu" is experienced.

The pregnant gilt may well gain 1 pound to 1½ pounds per day throughout the pregnancy period. The amount the sow gains will depend largely upon her condition at breeding time. Excessive fatness of the sow must be guarded against by exercise and through the use of protein and bulkier feeds rather than too much corn.

Whole dry oats fed in self-feeders, in troughs, or on a clean floor, along with enough corn fed by hand to keep the sows in gaining condition, form the basis for a satisfactory pregnant brood sow ration. Coarsely-ground barley or wheat may replace part of the corn in localities where these grains are as cheap as corn. The amount of these grains a sow will consume varies with the size of the sow and her condition at breeding. Gilts will need more in proportion to their live weight than old sows because the gilt is still growing. One-fourth to one-third of a pound of 60 percent protein tankage, with access to good legume hay such as alfalfa, clover or soybean, will supplement the grains satisfactorily. If hay is not fed, ½ pound of the trinity mixture per day is better than the straight tankage. Linseed oilmeal makes a better slop than tankage. Oilmeal, however, is generally a more expensive source of protein than tankage, and should not be used to replace tankage as the entire supplement.

A mixture, 75 pounds tankage and 25 pounds linseed oilmeal, is more satisfactory than either one alone.

Soybean oilmeal may be used to replace adequately half of the tankage or all of the linseed oilmeal.

Whole soybean grain fed at the rate of 1 pound per day to the brood sow will replace other protein supplements during the gestation and suckling periods. When soybeans are fed to replace other proteins, a mineral mixture is essential because soybeans are deficient in mineral ingredients. A satisfactory method of using soybeans in the brood sow ration is in the form of hay.

Skimmilk or buttermilk, fed in amounts of 1 gallon to 1½ gallons per day per sow, along with corn, oats, and legume hay makes an excellent ration. If slopping is practiced, one-half ground oats and one-half middlings or ground wheat make a good mixture if corn and other protein feeds are fed in addition.

Weakness of the back and hind legs of brood sows suckling pigs sometimes occurs when the litters are large. This trouble may be caused by mineral, protein or vitamin deficiencies in the feed. To prevent this trouble, provide plenty of these materials in the ration of the pregnant sow. This practice is much more effective than an attempt to cure the difficulty. Experience shows that feeding all the alfalfa hay sows will eat helps prevent paralysis of the hind-quarters. If such trouble has occurred previously on the farm it is a good plan to force-feed minerals. Use a simple mixture at the rate of 4 to 5 pounds with each 100 pounds of protein supplement. Ordinarily self-feeding of a simple mixture is sufficient to take care of the mineral needs of the sow. Certain families of swine, nevertheless, show a predisposition to develop a form of paralysis of the back and hind legs, even though the sows are well fed. A change of breeding stock is advisable under such conditions.

Legume hays such as clover, alfalfa and soybean contain high quality protein and mineral elements such as calcium and phosphorus. They are also rich in vitamins necessary for health and growth.

Roughage distends the digestive apparatus and develops roomier brood sows. In localities where alfalfa is plentiful and cheap, it may make up 50 percent of the total feed consumed by the pregnant sow. When feeding this much it should be ground. In smaller amounts, such as ½ to 1 pound per day, it is just as well to feed it in the form of hay in racks or in the nest.

Allowing brood sows to follow cattle is a common practice *but*

none too safe. The danger lies in sows getting bunted or kicked. This hazard can be lessened some by removing the sows a week or two before farrowing. Even though protein supplement is fed to the cattle, additional grain and protein supplement should be fed by hand to the sows during the latter half of the pregnancy period. The greatest increase in the weight of the foetuses comes at this time, bringing the greatest need for protein, mineral and vitamin substances.

Exercise is best obtained by allowing pregnant sows to forage in the stalk fields or in a field where corn and soybeans have been hogged-down. In an open winter sows may graze on the meadows and have access to the cornfields. A closed winter with heavy snowfall often necssitates forcing the sows to rustle for part of their feed in order to get sufficient exercise. This is accomplished readily by scattering their feed some distance from the sleeping quarters.

Farrowing Time

Scrub the pen with scalding hot water and lye (1 pound lye to 30 gallons water) and bed rather lightly with clean straw.

Many a pig will be saved by placing a fender about the pen. A suitable fender is a 2 x 4 placed along the sides of the pen, 8 inches from the floor.

Give the sow an opportunity to become accustomed to the pen before farrowing. It is well to shut her in the pen at night and let her out during the day to allow her exercise and to help prevent constipation. Brush or wash off all dirt and filth from the belly and udders before she farrows. A solution of warm soapy water to which a small amount of dip has been added is adequate.

A ration made up largely of whole dry oats, or a light slop of ground oats and bran is all the sow need be fed just prior to farrowing.

Usually when milk is in udders, the sow will farrow within 24 hours. Be on hand if possible when she does—it may mean saving a pig. If the weather is cold, have a basket with some warm bricks covered with a gunny sack in the bottom. Dry the pigs off and put them in the basket until the sow is through farrowing. If the weather is warm this is not necessary, or if the sow farrows during the day it may not be advisable, but if she farrows during the night it is often best to take the pigs away and return them in the morning. One strong pig may be left with the sow to keep her contented.

For a couple of days following farrowing, feed only whole dry oats or a light slop. If the sow is constipated and shows a tendency to feverishness, ½ pound

linseed oilmeal or bran added to the slop will be beneficial. Heavier feeding may be begun 4 or 5 days after farrowing when most danger from fever has passed. At the end of a week or 10 days the sow should be consuming a full feed. Sows suckling large litters are often allowed to become greatly reduced in flesh through insufficient feeding. There is nothing to be gained by this. Feed the sow heavily and maintain her weight if possible.

The Suckling Sow

Self-feeding of sows nursing pigs reduces labor, stimulates milk production and helps maintain the flesh. Self-feeding may be begun about 10 days after farrowing. A ration of shelled corn, whole or ground oats and the trinity mixture may be self-fed with excellent results. Barley or wheat may replace some of the corn. Other protein supplements, such as soybean oilmeal, whole soybeans, or a mixture of ¾ tankage and ¼ linseed oilmeal may be used when available and economical in price. Between 1 and 2 gallons of skimmilk or buttermilk is a good replacement for other protein feeds.

Although slopping of hogs is a rather disagreeable way to feed, the practice has a great deal of merit, especially with young sows nursing large litters of pigs, if they are not on pasture. Consumption of feed and water may be increased where slopping is practiced. Slopping also aids in keeping the bowels of the sow in good condition.

A good feed mixture for slop consists of 100 pounds of ground oats and 100 pounds middlings, to which 50 pounds of tankage or 60 pounds trinity mixture has been added. This mixture, with water or milk, fed in thick slop with full feeding of corn will give satisfactory results. Allow the nursing sow free access to minerals. The above rations are satisfactory either for pen or pasture feeding, although the alfalfa hay or meal is not as essential on pasture.

"Drying up," or failure to produce milk when suckling pigs is a common complaint of swine producers. This may be due to any one of a number of factors, such as fever in the udders, overworking of the sow, an inadequate diet, or the lack of inherent ability to produce milk.

Fever in the udders may be caused by overfeeding shortly before or at the time of farrowing. It is also caused by sows lying on a cold floor. When fever occurs the sow is usually restless and refuses to let the pigs nurse. Milk congests in the udders, and the sow may actually dry up.

A run-down condition due to overworking with previous litters may also cause sows to dry up. Sows should come to farrowing

time in a gaining condition and carrying a fair amount of flesh. The sow does not usually eat enough feed immediately following farrowing to provide for the milk flow for a large litter. Therefore she should have some reserve flesh to draw upon until she is consuming a full ration.

An inadequate diet is a frequent cause of failure to milk well. A ration made up entirely of corn is deficient because it lacks protein, a necessary ingredient for milk production. Swine producers often make the remark that their sows dry up although they are feeding all the skimmilk or buttermilk the sows will drink. The probabilities are the sow is not eating enough other feeds such as corn, oats, middling and tankage which furnish dry matter out of which milk may be made. Dry matter in the ration is necessary as water for milk production. Two gallons of buttermilk or skimmilk probably represents about the maximum amount of milk which should be fed with grain daily to the brood sow. When adequate rations for milk production have been fed and other known requirements met and there is still little or no milk produced, it is probable that the pituitary gland, the nervous mechanism that controls milk production, is not functioning. This most frequently occurs when the sow has been badly overworked as a breeding animal by producing two litters during the season.

Finally, some sows are naturally poor mothers and milkers. They are not of the right make-up. Swine have gone through extreme changes in type, from short chunky individuals to the extreme rangy type. They have been developed in years past from the lard point of view. Corn has been used heavily in the rations. The production of lard and meat has been the main objective and there are many sows produced and saved for brood sows which are failures when it comes to nursing a large litter of pigs. More emphasis needs to be placed upon this quality in the selection of gilts. Save those which come from large, well nourished litters.

Time to Think About Buck Rakes

Condensed from Eastern States Cooperator

Hollis R. Davis

THE harvest season will face the farmer with the problems of less new machinery and less labor.

The buck rake may be one answer to the harvesting of the hay crop, bringing in green hay for grass silage, hauling combined straw to the barn or to the baler, bringing corn bundles from the field or grain shocks from the field to the barn or thresher.

The main advantages for the use of one of these rakes are that it reduces man-hours per ton required to put up hay, it eliminates the hard labor of loading on wagons and makes the hay easier to handle in the mow. A brief comparison of average tons per hour by crew and average man-hours per ton as compiled by F. I. Morison, department of rural economics, Ohio State University, shows that auto buck rakes average 1.8 tons per hour by crew as compared to 1.1 by wagon and loader. The average man-hours per ton by wagon and loader is 3.1 as against 1.7 by buck rake.

During the 1942 season in New York, several hundred of these rakes were built under the supervision of the 15 district agricultural engineers working on the Emergency Farm Machinery Program with the country agricultural agents. Many of these buck rakes were built following the demonstrations. A number of the operators have said that the cost of the rake was paid for in the first season by the saving on cost of labor alone. Others stated that one man with a rake can do as much work as a three-man crew using the hay loader method.

Let us consider some of the points to keep in mind concerning a good buck rake. The essential requirements of these rakes are as follows:

A. A good power lift sufficient to lift a load of 1000 pounds or better to the required height of at least four feet. A power lift is stronger, faster and saves a lot of time and hard work over any hand mechanical lift.

B. Speed of at least eight miles per hour. This is important in long hauls.

C. Capacity of 500 to 1000 pounds or better. On long hauls and in double-loading the rake must be able to handle this size load.

D. The rake itself should be

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well built. A poorly built rake will cause trouble in loading, lifting, and in carrying the load.

Buck rakes can be mounted on cars, tractors or trucks. Since the truck has so many advantages over the other two methods, this discussion will deal with those mounted on old trucks.

A long-wheel-based truck is preferable to one of the short pick-up type. A truck gives good traction while loading and when the load is lifted ready to carry, it gives good driving vision and ability to take the load around corners, through gates, less whipping the teeth while loading, and a sturdier source of motive power.

The power lift is one of the most essential parts of the rake. It is the most difficult part of the rake to build in order to have it operate correctly. It should have sufficient lift to raise the end of the teeth at least four feet above the ground. Mechanical hand lifts take a lot of "elbow grease" and take time which it is essential to save.

A power-take-off attached to the transmission and connected to a used rear axle that is equipped with good mechanical brakes and mounted on the frame of the truck back of the driver's seat is the best power lift. A small winding drum is welded to one of the drums and serves to wind up the rope or cable that lifts the rake. A lever is attached to the rear axle and connected with the brakes in such a manner that when one of the brakes is locked the other will wind up the cable, and when the lever is released it will lock the wheel on the side of the winding drum, thus holding up the load.

Another popular method is to cut off the rear axle near the center housing, welding a plate over the stub shaft and against the housing, thus locking that side of the axle from turning and also preventing any grease from running out. Another way of locking the differential is to weld the spider gears—one axle is removed, the housing is cut off, and over it is placed a cap. The differential is mounted on the frame the same as the first method and attached to the power-take-off in the same manner. If the differential is locked, it is necessary to engage the power-take-off each time the load is lifted, while in the former method the power-take-off is engaged all the time and the rear axle is running continuously.

Either method will give the necessary height for lifting and a truck has sufficient power for lifting the load.

The rake itself should be about 10 feet six inches wide and about 12 feet long. It has 12 teeth cut diagonally from 2 x 6's, each 12-foot 2 x 6 making two teeth tapering from four inches at the base

to two inches at the point. Teeth should be made of ash, Douglas fir or oak.

These teeth are spaced 11 inches from center to center and attached on top of their backs to two 4 x 4 "bed" pieces. The uprights or backstops are made either of wood or of welded steel angle irons. If wood is used, 2x6's should be used for the uprights and for the braces and if steel is used it should be fairly heavy. Whichever is used, it must be strong enough to stand the pressure required to lift the rake and the hay. All of the wood should be planed and treated with linseed oil to prevent weathering and to help in the polishing of the wood, especially the teeth, to insure good loading.

The rake itself is mounted to the truck by means of a pair of hangers welded to the truck frame. The rake is held in position by means of a rod through the hangers. It is well to have a series of holes in the hangers to adjust the rake for the best operating height, since all rakes do not work best at the same height. Usually six inches to eight inches is the best operating height. The rake should be so mounted that the uprights on the rake will clear the truck frame in the raised position. The rake should be attached far forward under the frame of the truck to aid in the lifting.

The lifting of the rake is accomplished by means of pulleys and rope. A pulley is attached to each of the two center uprights on the rake and a third to the frame of the truck. The rope or cable for lifting is attached to the frame of the truck, then run through the pulleys and attached to the winding drum of the hoist.

The buck rake may be used to take hay from the swath or from the windrow. The faster method would be to take hay from double windrows made with a side delivery rake. Windrows should be turned a short time before using the rake. It is desirable on long hauls to "double-load." This is the lifting of a second load, placing it on the first load and taking both loads at the same time. Sufficient speed is necessary to insure that the hay will slide back over the teeth.

Slings and four-prong loose-grapple forks are used to raise the hay into the mow. The slings, which are the best for the job, are spread out on the floor, the load of hay dropped on them and the rake pulled out. If slings cannot be used, a grapple fork is next best.

The buck rake is a new haying tool. A farmer must learn to use it in the field.

Let Ants Do the Work

Condensed from Farm and Ranch

Glen Briggs

Soil Conservation Service, Fort Worth, Texas

ANTS always have had the reputation of being industrious and conserving food supplies for use as needed. Ants may have been the first conservationists, forerunners of food conservationists, and soil conservationists.

But it was not discovered until recently that the red ants were, in fact, an aid to the soil conservationist and could help to speed the application of soil-conservation work during present shortages of labor.

Their help comes with their storage of buffalo grass seed, a most difficult grass seed to harvest. Because of its importance in the revegetation of eroding cultivated land and in the improvement of pastures and ranges for increased livestock production, buffalo grass is an important soil-conservation plant.

Buffalo grass seed burs already piled in quantities up to 5 pounds may be found around red ant hills. Apparently the seed is collected and stored for a winter food supply. Not only is it stored below ground, but when the seed burs are plentiful—as they generally were in 1943—the seed also is left around the edges of the ant hills as a reserve supply.

The seed of this important native grass is difficult to harvest because the burs are produced very close to the ground, below the reach of most harvesting equipment.

Considerable amounts of seed, however, may be harvested by robbing the ants. In one area in North Central Texas where tests were made, it was found that around one hill there were 8.8 pounds of uncleaned burs which produced 6.4 pounds of clean seed burs suitable for planting 1 acre. In the same 5-acre pasture there were approximately 40 ant hills that would yield about 80 pounds of 73 per cent pure buffalo grass seed burs. At the present price these seed would be worth $80. To sweep the seed from the ground and clean them required about 20 minutes for each ant hill. The seed can be swept into piles with a heavy warehouse broom and picked up with a shovel. Best seed supplies are found in closely grazed pastures.

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If you don't have the ants to do the work for you, sweep with a heavy broom the burs from a closely grazed buffalo grass pasture. In some of the fields where buffalo grass produced a good crop of seed, one man collected as much as 30 pounds a day. If this seed is needed on the farm, here is a relatively low-cost method.

Not long ago the U. S. Army, at the suggestion of a Soil Conservation Service technician, successfully used a street sweeper to collect buffalo grass seed from Oklahoma City golf courses. The seed was used to control erosion on military areas.

Buffalo grass seed burs exposed to the weather are generally better than those harvested early in the fall and give a better and quicker germination. The whole bur, which contains one to four seeds, is planted. Seed burs that were plump and contained viable seed can be collected any time of the year.

The Rochdale Pioneers

Condensed from Iowa Farm Economist

Frank Robotka

THIS year marks the 100th anniversary of Rochdale cooperation, which will be celebrated all over the free world.

The social and economical significance to the world of the opening of the little cooperative store on Toad Lane in Rochdale, Lancaster, England, on December 21, 1844, will probably never be fully or accurately evaluated. No one is able to say what might have been had the utopian ideas of Robert Owen, a rich and philanthropic manufacturer, not been brought closer to earth by William Thompson and Dr. William King, and finally pounded out on the anvil of cold, hard realities by the 28 so-called weavers of Rochdale. (Only 7 were in fact weavers; among the others was a tailor, a printer, a fish hawker, a clogger, a shoemaker and two wool sorters.)

The Rochdale idea was by no means enthusiastically received. But in spite of jeers and ridicule, the Pioneers struggled on, and the enterprise prospered.

By 1935 the original membership of 28 had increased to 7½ million, 16 percent of the total population. This is about 6 out of 11 families of Great Britain. The original capital of 28 English pounds had grown to over 800 million dollars. Total sales in 1935 were nearly 2 billion dollars.

Since co-operation and other schemes attempted before 1844

Reprinted from the Iowa Farm Economist, Ames, Iowa

did not survive, what was there about the Rochdale experiment that caused it to thrive and spread over almost the entire civilized world? Many factors, no doubt, contributed to the success. The Rochdale pioneers had the benefit of many years of previous experiments not only in communal schemes but cooperatives.

Most of the previous schemes contemplated more or less common ownership of property and sharing in common in the fruits of the labor. In fact, many of the previous attempts were tinged, if not deeply dyed, with socialism and communism. They sought "a brotherhood of workers who would eat, labor, and own things in common." Moreover, there was considerable promotion and financing of schemes by sympathetic but misguided philanthropists.

The turning point came when the Pioneers concluded that they must rely on their own resources and that some economic relief might be gained in the market place through soundly organized self-help business organization.

The Rochdale plan, instead of forcing human beings to conform to the dead level of a common pattern, struck responsive chords in human nature. It appealed to their spirit of self-reliance and dignity as self-respecting and free human beings. It challenged their initiative and enterprise, as it offered an opportunity and a ray of hope to improve their lot.

Perhaps the most significant departure was the recognition of individual property rights and the right to participate in savings according to the individual's patronage. Althought some of the Pioneers undoubtedly still believed in the ideology of some of the "isms," their cooperative enterprise was distinctly a private enterprise, organized, financed and operated by private individuals without outside assistance, for their individual, private benefit.

The Rochdale experiment represented an uncanny recognition of sound, practical business as well as cooperative principles, in contrast with much of the visionary thinking of that time.

The Rochdale Pioneers had demonstrated how business could be conducted successfully on a plan which made the patron the beneficiary, that is, on a cooperative basis. Although attempts at cooperation had been made before, the Rochdale enterprise was the first to combine enough of the essential features of cooperative business practice and administration and to work out their details well enough to enable a cooperative to establish itself as a permanent business institution. The fact that during the past 100 years their methods have been adopted and have proved success-

ful in every important country of the world lends significance to their validity.

The rules and methods of Rochdale Cooperation:

1. Membership open to everyone at low cost.
2. Members join and withdraw voluntarily.
3. One vote per member and no proxy voting.
4. Limited, fixed return, if any, paid on share capital.
5. Goods sold at prevailing local prices.
6. Trading on a cash basis.
7. Both sexes to have equality in membership rights.
8. Education of members and non-members with reference to cooperative principles; percentage of savings allocated for educational work.
9. Accounts properly kept and audited and reports represented regularly to members.
10. Regular and frequent meetings for the discussion of the cooperative's affairs.
11. Class, political and religious neutrality.
12. Distribution of savings, in excess of costs and reserves, on basis of patronage.
13. Expansion and federation.

Rochdale cooperation has provided the pattern for cooperatives in some 40 countries. It is erroneous to conclude, however, that it has been the pattern for all kinds of cooperation. With the exception of purchasing, local grain cooperatives, and some other cooperatives, the "agency" type of organization is better suited to farm products marketing cooperatives.

The agency type is, in fact, regarded by some authorities as the true cooperative type of organization. The non-stock, or membership, type of organization is used by 51 percent of the incorporated agricultural marketing cooperatives in the United States. Nearly 90 percent of the United States cooperatives, excluding grain and purchasing, do not buy and sell "at prevailing local prices," but act as agents for their members on either a pooling, commission, bargaining or auction basis. Our creameries tend to follow the Swiss or Danish pattern; the credit cooperatives received their inspiration from the German Schulze-Delitzsch and Raiffeisen systems.

Although the Rochdale Pioneers may not have given us the last word regarding cooperative organization and methods, this should in no sense detract from the fact that their accomplishment has had great influence not only on urban consumer cooperation but on agricultural cooperation. Their outstanding contribution was the demonstration that business could be organized by and operated successfully in the interest of *patrons*.

Pasturage Alone for Fattening Yearlings

Condensed from The Cattleman

J. H. Jones
Texas Agricultural Experiment Station

C. J. Whitfield
Soil Conservation Service

CONFRONTED with the present feed price-beef price situation, it becomes necessary to consider pasturage alone as a fattening feed. A normal economy that would permit the use of concentrate feeds after the stocking period is highly desirable from the standpoint of getting quantity, quality, speed and flexibility in beef production.

Work at the Amarillo Experiment Station during 1942-43 is presented as an example of about the best that can be expected in producing desirable yearling steer beef from pasturage alone.

Of the four groups which were grazed on different kinds of pasturage two are selected for this discussion. Group 1 was grazed throughout the summering period on a 43-acre pasture of native blue grama and buffalo grass.

Lot 3 steers were grazed on a 75-acre native pasture containing a dry lake bed of about 10 acres except for 56 days on sudan in the period July 6 to August 31.

Both lots of steers were sold in Fort Worth October 4, 1943. Lot 1 averaged 823 pounds and brought $11.00 per cwt. Lot 3 averaged 882 pounds and brought $12.25 per cwt. The amount received per head was $90.53 for Lot 1 and $108.04 for Lot 3 or $17.51 per head more for Lot 3 steers. The average daily gain basis market weight for the 167-day summering period was .96 pounds for Lot 1 and 1.34 for Lot 3. OPA carcass grades were the same for each lot but Lot 3 steers were higher in the grade than Lot 1 steers and Lot 3 steers made a dressed yield basis hot carcass weights of 57.9 per cent as compared to 57 per cent for Lot 1.

It is thought that the Lot 3 steers did about as well as can be expected of yearlings produced entirely from pasturage. Lot 1 steers weighing out 823 pounds at the market were above the average grass yearlings. Without question the winter wheat pasturage contributed a

Reprinted with permission from The Cattleman, April, 1944, Fort Worth, Texas

great deal to their development. The winter of 1942-43 as is well known was excellent for wheat pasturage.

There was a difference in the summer pasturage viz., 59 pounds per steer as weighed at the market, $1.25 per cwt. in selling price and $17.51 per head in total return. Certainly if one expects to market grass fat yearlings or cattle at any time it should pay to provide them the best available pasturage. It is also apparent that if one wants heavy yearlings in the fall, it will be necessary to start with heavy calves the preceding fall, and in addition winter them well enough to get a good winter gain.

As to why Lot 3 did better than Lot 1, it is thought that the plants, call them weeds or forbs or what not, growing in the dry lake bed were the principal difference. The steers spent a great deal of time in the lake bed. They also had a wide selection of forage and a lot of room. They had the same grasses as Lot 1 plus the lake bed pasturage plus sudan in July and August. It was not entirely clear in this case as to whether the sudan contributed materially or not, but as a matter of principle, it appears to be good practice to provide supplementary green grazing in the mid-summer period when native pastures tend to dry out.

The fact that creditable slaughter steers were produced in approximately 20 months and at a profit from pasturage alone shows the adaptability of a grazing system which provides an abundance of pasturage during these times of shortage of concentrate feeds.

Spreads Haying Season

To avoid too much haying at one time, some farmers in Dunn county, Wisconsin, clip early growth of alfalfa on part of their acreage. This delays maturity of the crop in those fields. Such clipping is done about the last of May and 3 or 4 inches of the 6- or 7-inch height is removed. Other farmers accomplish the same purpose by turning a heavy stocking of cattle on a portion of the acreage to graze off about the same length in a short time.

—*Capper's Farmer*

Grass Silage and Hay Improve Wartime Rations

Condensed from Turkey World

H. H. Kauffman
Pennsylvania State College

GRASS silage has possibilities of being one of the better home-grown feeds to help out the wartime turkey feeding problems. Its use can be beneficial for breeding turkeys; for turkeys reared on wire, slatted or board floors; or birds with inadequate pastures on range; and also as a winter feed. Silages made from good grasses range from about 15 to 25 percent protein on a dry matter basis and also contain many of the essential vitamins.

Some commercial turkey growers in Pennsylvania have been feeding silage for several years, and Paul Margolf, turkey research man at Pennsylvania State College, has been studying and observing it under experimental conditions. Grasses generally used are Kentucky bluegrass, rye grass, timothy, and golf course and lawn grass mixtures. Among the legumes alfalfa, little white, red and Ladino clovers are the more common varieties in the mixtures of grasses that are generally ensiled. Hollow stemmed plants are more subject to spoilage because it is more difficult to expel all the air from the hollow stems when they are packed into silos, barrels or oil drums.

Since grass silage for poultry is still in the experimental stage, many poultrymen are packing the silage in small containers like barrels or oil drums. Several Pennsylvania commercial chicken growers feel that grass silage is here to stay and have constructed small silos solely for poultry feed. On many general farms, the farm flocks of hens are fed from the supply of grass silage that is used for the dairy and beef cattle.

Growers report that they can pack between 200 and 300 lbs. in an average sized oil drum or barrel, and use molasses or ground corn for the preservative. The amount of molasses often used by poultrymen is 5 lbs., mixed with 5 lbs. of water per 100 lbs. of grass or 10 to 15 lbs. of molasses per barrel of silage. This is more than is recommended generally, since some studies indicate that 2 lbs. of molasses is sufficient, but some poultrymen

Reprinted by permission from the Turkey World, April, 1944, Mt. Morris, Ill.

use considerably more than 5 lbs. per 100 of silage. Ground corn mixed with the cut grass will preserve the ensilage, and the general recommendations are 250 lbs. per ton of cut grass. The poultrymen often use from 25 to 35 lbs. per barrel. The grass should be cut in ¼ in. length, if possible, but some growers report satisfactory results with 1½ in. length cuttings. Coarser cut grass does not pack as readily, and it is more difficult to expel the air. Air is the enemy of silage, as far as its keeping qualities are concerned.

What results were secured from feeding grass silage? The following are some of the comments made by Pennsylvania growers that are using it. First, there may be some difficulty to get certain groups of turkeys to eat it, but after they develop a taste for silage, they eat it with relish. One hundred breeders will consume from 15 to 25 lbs. per day. Alfalfa was the predominating grass used.

While none of these growers kept a check pen of breeders to see if the grass silage increased the hatchability, they reported they felt it enabled them to get more poults per 100 eggs. These growers also reported good livability of the poults, and that the breeder hens and toms maintained better plumage and flesh condition throughout the breeding season. The experiences of these turkey growers are similar to producers of baby chicks who generally report that grass silage increases hatchability with many rations and can help to produce those peppy chicks that jump out of boxes when the lids are removed.

One grower used lespedeza and found the turkeys were slower in cultivating an appetite for it, but after they got accustomed to its flavor, they ate larger amounts than alfalfa silage.

Legume and mixed hay is another feed for turkeys which may have more potential value than is generally appreciated. Many turkey growers have been using hay for feed and litter for several years.

Margolf, of the Pennsylvania station, found that growing turkeys started to consume considerable amounts of alfalfa hay when eight to ten weeks old. This hay was cut up with a hammer mill with a coarse screen. The amount of alfalfa consumed increased steadily to about 10 lbs. per day of leaves and stems per 100 turkeys at 16 weeks of age. That seemed to be about the maximum amount the turkeys would consume even after they got older. This hay averaged about 14 percent protein, and the toms in the hay fed groups averaged one pound and the females half a pound heavier at maturity. While there was little trouble

with cannibalism in any pens, Margolf reported practically none in the pens fed alfalfa hay.

Margolf also reported at the Pennsylvania Turkey Growers' meeting last October results of his studies in feeding golf course clippings. This grass was cut whenever it made about an inch of growth and dried in the shade so that it was unusually tender, palatable, and averaged 31 percent protein on the dry matter basis. Four to 5 lbs. of these dried clippings were soaked in 8 to 10 lbs. of water and fed per 100 turkey breeders per day. Those turkeys were fed a ration that is normally considered a good breeder ration, but the breeders that were fed this soaked grass in addition to the regular breeder ration produced eggs that had 10 percent higher hatchability.

Several flocks of confined young turkeys were fed all the dried golf course clippings that they wanted to consume after 10 weeks of age. These dried clippings were fed with a ration that grew good turkeys confined to shelters without access to greens or hay. One hundred young turkeys ate about 15 lbs. per day at 16 weeks of age when they reached the maximum consumption. The turkeys fed the clippings ate as much grain and mash as those groups that did not get dried grass, but at 28 weeks of age the toms in the dried grass groups averaged 2 lbs., and hens one pound heavier.

Wilmer Claar, White Holland breeder, Queens, Pa., reported that he fed about 15 tons of alfalfa, clover and mixed hay to his breeders and late hatched turkeys during the fall and winter of 1942-43. Claar used cut hay for litter for the young poults and found it well suited both for litter and controlling cannibalism. He reported that he did not find it well suited for litter, however, until after the poults were about eight weeks old. The baby poults had a tendency to eat too many alfalfa and clover leaves and not enough starter mash.

Baled legume or mixed hay can be fed to turkeys in the bale without removing the wires or twines, since the turkeys will tear the hay from the bales. The wires keep the stalks of hay anchored and the turkeys can break off small bits of hay. That can help to keep the problem of crop bound condition to a minimum, which is experienced at times when birds eat long strands of loose hay. Bales can be tied to partitions, posts, etc., and the wire tightened up before the partially eaten bales collapse completely. Tight floors should be placed over wire or slatted floors where the hay is fed to prevent the leaves from falling through the floor. Leafy alfalfa hay that is bright green in

color is considered one of the best quality hays, and leafy clover and soybean hays are good.

During the fall, winter, and spring of 1943-44 Margolf is conducting a series of tests to determine the relative feeding values of silage and hay to both breeder and growing turkeys. This work should be of importance to commercial turkey growers, because if good quality hay can give similar results as silage, it can save labor and expense, since grass silage requires more labor and expense to preserve than hay in good drying weather. Hay also is handled more easily through commercial channels.

Beet Tops — A Feed Resource

Condensed from Pacific Rural Press

H. R. Guilbert

College of Agriculture, Davis, California

CONSERVATION and efficient utilization of beet tops offer one of the greatest possibilities existing in California to increase meat supply.

Plans are under way to use numerous topping machines and other harvesting devices. This should make possible more economical handling of tops than has been possible in the past. On the other hand removing tops from the field will also facilitate mechanical harvesting of the beets.

Many beet growers are not livestock men and most livestock men are not beet growers. Progress in facilitating mechanization of harvesting of beets and effective utilization of these important feed by-products will depend upon the extent to which these two groups of producers can get together on a mutually advantageous basis.

Few realize that the total feed value in beet tops is at least 1½ times that of beet pulp from the same beets. The dry matter in beet tops averages about 10 per cent of the weight of the beets produced. Digestion and metabolism trials show that the value is higher than a like amount of alfalfa dry matter. The feed replacement value is equal to 150 pounds of barley or 230 pounds of alfalfa for each ton of beets harvested.

It is estimated that only 35 to

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40 per cent of the total beet top acreage was utilized by livestock in 1942. Approximately 80 per cent of this acreage was used by beef cattle. The estimated yield of beef per acre was about 60 pounds. The maximum utilization by pasturing scattered tops in the field yields about 90 pounds live weight gain per acre.

If all of the tops were harvested and made into silage or otherwise conserved and fed in mixed rations, the return could be increased to between 150 and 250 pounds of beef per acre. The estimated total production of beef from tops in 1942 was about 3 million pounds. This could have reached more than 12 million pounds even with a 50 per cent reduction in acreage last year, if all the crops were harvested and conserved by making stack silage and fed in suitable rations.

The best method of conserving beet tops thus far developed is to stack the green or slightly wilted tops in a place convenient for feeding. Successive layers must be added so that the height of the settled stack is at least 7 feet. Care must be taken to exclude dirt.

Extensive work was done on nutritive value and utilization of beet tops in European countries during the last war and we may be sure that no such waste is permitted in Germany or Axis dominated countries or in England.

Labor cost and lack of economic necessity have been the principal causes of this waste in the past. Labor will again be a factor this fall but in view of the very high price per ton for hay; other feeds correspondingly high; the possibilities for mechanical handling; and the necessity for maximum production, perhaps something can be done about it.

This is a matter on which sugar companies, beet growers, livestock men and the Agricultural Extension service should get together in the near future.

Nutrition Deficiencies of Calves

Condensed from Guernsey Breeders' Journal

W. E. Krauss

Chief, Department of Dairy Husbandry, Ohio Experiment Station, Wooster, Ohio

ANALYSES of statistics have shown that in large herds 12 per cent of the calves born were dead or died at birth and 11 per cent of the calves born alive died early in life. Reduction of this 23 per cent loss of potential future herd replacements can probably best be brought about by a combination of good management, disease control, and proper nutrition. As there seems to be a definite relationship between the nutrition of dams and the health of newborn calves, one of the first steps in a successful calf raising program would be to feed the dams adequately and properly, and would tend to emphasize proper feeding during the dry period.

Calves, like all animals, need air, water, salt, protein, minerals and vitamins. Above all they need energy, which is supplied by all feeds. A deficiency of energy, the symptom of which is emaciation, is most apt to be caused by an insufficient intake of feed and probably occurs only because of ignorance, neglect, or an actual scarcity of feed. It may also be caused by orneryness on the part of the calf by refusing to eat. This requires a course in calf education.

At birth the energy requirement is readily met by the colostrum or the six to eight lbs. of whole milk allowed daily during the first week, preferably from the dam. Since the energy requirement increases with size, the milk intake should increase correspondingly. When whole milk is fed at the rate of one lb. to ten lbs. of live weight the energy requirement will be met. Later, grain and hay are added as sources of energy and can replace milk entirely for this purpose.

Little is known about the protein needs of young calves. Whole milk contains 3.5 per cent protein; on a dry basis about 27 per cent protein. So long as milk is fed at the rate of one lb. to ten lbs. of live weight the protein requirement will be met during the first month. If milk feeding is continued a grain mixture containing 10 to 15 per cent protein is adequate with legume hay, and at least 15 per cent protein is needed with non-leguminous

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roughage. Experience has shown that when milk is fed in limited amounts a grain mixture containing 15 to 20 per cent total protein is adequate. Likewise, calf meals and calf starters containing 18 to 24 per cent protein have been used successfully.

Actual protein deficiency in calves should rarely be encountered. Failure to grow is a cardinal symptom of protein deficiency, but should be distinguished from emaciation due to starvation or insufficient energy intake.

During the first month to six weeks, quality of protein probably is of importance because the rumen is not fully developed and synthesis of protein is either absent or present only in a small degree. Normally during this period whole milk is fed, thus supplying the quality of protein that dry feeds may not have. It is difficult to supply protein adequate in quality without the use of some milk; therefore, a total of 250 to 350 lbs. of whole milk during the first four to seven weeks is recommended in addition to colostrum during the first two days to supply the globulins needed to build up immunity to infections.

After the rumen develops the protein supply is augmented by that derived from different plants and from the bacteria and infusoria that are present in vast numbers. As the calf develops its protein-manufacturing apparatus the need for high quality feed protein is reduced, milk can be eliminated, and rather simple combinations of dry feed can serve as protein sources. In a recently completed experiment conducted at the Ohio Experiment Station calves fed an all-vegetable protein calf starter performed just as well as others receiving a starter containing 12½ per cent of fish meal. Both groups received 250 lbs. of whole milk per calf during the first month and hay and water were given according to the usual procedure.

Salt, iodine, calcium and phosphorus are the minerals that must be watched in calf feeding. Salt hunger, loss of appetite, rough hair coat and poor condition are symptoms of salt deficiency. Iodine deficiency is evidenced by palpable or visible goiter in the new-born. Both deficiencies are readily cured or prevented by making iodized salt available, usually at the rate or one per cent of the grain mixture. (In the case of iodine deficiency in the newborn prevention begins with the dam.)

Calcium and phosphorus are needed in rather large quantities by rapidly growing calves. The external symptoms of calcium and phosphorus deficiencies are similar; retarded or stunted growth, depraved appetite, stiffness, and fragile bones. So long

as milk in some form is fed, calcium and phosphorus will be adequately supplied. After milk feeding has been discontinued legume or legume and grass hay, together with grain mixtures containing high phosphorus feeds, such as wheat bran and the oil meals, will furnish adequate amounts of calcium and phosphorus. Because legume hay often is not available and because cereal grains may constitute the grain mixture entirely, it is often recommended that grain mixtures for calves and heifers contain one per cent of calcium and phosphorus supplements such as steamed bone meal or dicalcium-phosphate for both calcium and phosphorus, and ground limestone as a source of lime only. High-fluorine rockphosphates should be avoided.

Iron, copper and cobalt are inter-related in that they all contribute toward maintaining a healthy blood picture. Iron and copper are known to be needed for blood formation and when they are deficient anemia develops. In certain soil deficient areas the addition of iron, copper and cobalt to the ration has been beneficial. General need for such supplementation has not been demonstrated, nor has the need for additional manganese in the ration of calves.

Until quite recently the vitamin problem in calf nutrition seemed simple, for had it not been demonstrated that only guinea pigs, monkeys and man could not synthesize vitamin C, that the rumen was capable of synthesizing all the factors of the B-complex, and was not the calf a ruminant? This left only vitamins A and D for serious consideration when evaluating the vitamin intake of calves. The recent work of Phillips at Wisconsin, however, has pointed out strikingly the possibility that some of the water-soluble vitamins may be lacking in the ration of young calves and may need to be supplied in concentrated form.

The most critical period in the life of a calf is during the first few weeks. It is then that navel infection, scours, colds and pneumonia occur most frequently and are most difficult to combat. Nature does its best to supply the things needed at this time. Colostrum provides special protein material for building up immunity against infections. Colostrum also is many times richer in vitamin A then is ordinary milk. This compensates for the fact that the calf is born with little, if any, liver storage of vitamin A. Blood plasma carotene and vitamin A also are low. On the contrary the blood of new-born calves and the colostrum of their dams are well fortified with ascorbic acid (vitamin C). It is felt by Phillips that

since the blood ascorbic acid level falls rapidly after birth, supplementary feeding of ascorbic acid would be helpful. In pneumonia or inflammation of the navel the ascorbic acid content of blood is very low.

In some earlier work Phillips had obtained beneficial results from the use of a shot-gun mixture of factors of the B-complex in controlling calf scours. More recently he has attributed this beneficial effect to one of the B-vitamins, niacin or nicotinic acid.

That calves require vitamin A in their feed has been known for some time, for the classical symptoms of vitamin A deficiency—failure to grow, watery eyes, and night blindness—can be produced readily on an A-deficient ration. It was not until quite recently, however, that a definite relationship between vitamin A and scours and pneumonia was established. The Beltsville, Wisconsin, and Ohio Experiment Stations have all contributed to this finding. In our own case, for example, the incidence of pneumonia and mortality in calves were markedly reduced when 15,000 units of vitamin A were fed daily during a siege of scours and pneumonia. The most interesting observation of all, however, was that liver storage of vitamin A had been entirely depleted in calves dying from pneumonia. This observation has since been confirmed in humans. More recently still Phillips has presented data indicating that true vitamin A rather than carotene (provitamin A) is needed by young calves, suggesting that the ability to convert carotene to true vitamin A does not develop until later in life. This has the practical implication that fish liver oils and concentrates should be used as sources of vitamin A and suggests also that breeds, like the Guernseys, not capable of converting as much carotene to vitamin A, may need proportionately larger carotene intakes to supply their vitamin A needs.

A further practical feeding application of nutritional knowledge can be derived from some recent data of Moore at Maryland which show that it takes two days of colostrum feeding to raise the blood carotene and vitamin A levels to normal and that withholding of colostrum prevents the blood vitamin A and carotene levels from rising, with resulting illness and death.

After the milk feeding period the principal source of vitamin A for the calf is the carotene in hay where it occurs chiefly in the leaves. Green color is some indication of the carotene content of hay, but hay loses carotene with time and may do so without marked change in color. Conversely, lack of green color is not

always an indication of lack of carotene. It is desirable, therefore, to use hay that has not been stored too long. Because young calves often do not consume much hay it is desirable that a fish liver oil or concentrate be added to the grain or be fed separately, especially during the winter months.

Calves also require vitamin D in their feed, for the cardinal symptoms of vitamin D deficiency—stiffness, swelling of the joints, and rickets—can be produced readily by feeding a vitamin D—deficient ration. The vitamin D requirement of calves has been found to be between 300 and 400 U. S. P. units per 100 lbs. of live weight. The amount of vitamin A needed daily for best practical performance is 3,000 to 5,000 international units. At least one lb. of good quality sun-cured hay, or one lb. of a fortified calf starter would need to be consumed daily per 100 lbs. of live weight to meet these requirements for vitamins A and D. Since calves often fail to eat these quantities of dry feed until six weeks of age, and since milk cannot be depended upon to furnish these factors adequately, it would seem to be desirable to feed daily two teaspoonfuls of cod liver oil or one-half teaspoonful of cod liver oil concentrate during the first six weeks, especially during the winter months. Later, since many calves receive no direct exposure to sunlight until they are six months of age or older, it is convenient and cheap to use irradiated yeast as a source of vitamin D. This can be incorporated in the grain mixture at the rate of 0.5 lb. per ton.

It may be that we are approaching the point where the feeding of vitamin pills or capsules to young calves should be routine. Personally, I do not think there is enough evidence to warrant general vitamin supplementation, except for A and D, as previously indicated. On the other hand, if the evidence of Phillips is combined with the realization that the very young calf is not a ruminant and therefore may need more nicotinic acid and ascorbic acid than milk supplies, then some justification for wholesale prophylaxis may be found. It is my opinion that extensive trials are needed to establish this point, but when there is difficulty with navel infection, scours, colds and pneumonia certainly no harm will come from vitamin therapy and unlooked for benefits may even result.

Lettuce in the Home Garden

Condensed from New England Homestead

Paul W. Dempsey

AS one of the "Big Six" vegetables, lettuce is recommended by authorities for growing in all home gardens. And yet it is one of the most difficult of all vegetables to raise. Even the commercial growers find it a fussy crop to grow. Of all the vegetables grown by market gardeners in New England, lettuce provides the highest percentage of crop failures—probably more than one-third of the lettuce grown from seed sown in the field fails to produce a satisfactory crop. The reasons for this are:

1. Lettuce is a cool temperature crop. It particularly dislikes a combination of high temperatures and high humidity. Head lettuce is especially fussy in this respect.

2. Lettuce is 95% water and must have a continuous supply of moisture. A dry spell stops growth and usually results in a bitter taste and the plant shoots to seed. Yet, lettuce plants will not do well if the soil is too wet for more than a day or two.

3. Lettuce, to be of good quality, must be kept growing continuously and steadily. Therefore, growing conditions must be good.

   a. Soil must be in good tilth. Well-worked over and mixed.
   b. Plant food content sufficient and well balanced.
   c. Soil reaction about right — not too acid (below pH 5.5) not too sweet (above pH 6.8).

From the above, you can see that lettuce prefers a rather heavy, cool soil that is well prepared.

There are so many varieties of lettuce listed in most seed catalogues it is difficult to pick out what you should grow. Here are my suggestions:—

Old Butterhead Type

White Boston is by far the best variety for sowing throughout the season. It produces a good sized plant of a light green color with no red tinge—the size and firmness of the head itself will depend upon growing conditions which will naturally change from week to week.

May King is to be recommended only for growing very early,

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when the cool weather will last until the heads are formed.

Big Boston has little to recommend it for growing in New England.

Black Seed Tennis Ball or Salamander was for years the standard summer head lettuce but is not nearly as good as *White Boston.*

Crisp Head or Iceberg Type

Great Lakes is a new variety of great promise because of its high quality and resistance to tipburn. Most seedsmen list it this year as a specialty, and in some instances at high prices. Try it. I have grown it in my own garden for two years with great success.

Imperial 847 and New York 12 are two of the many numbers of these two varieties of lettuce that have given best results in New England gardens.

Mignonette is a dwarf, small headed, reddish leaved lettuce that is worth planting in the home garden in short rows every month during the growing season. I sow it April 15—May 15—June 15—July 15 and August 1.

The regular *Iceberg* variety has little to recommend it for either home or commercial garden.

Loosehead or Leaf Lettuce

Oak Leaf is an old variety but an improved strain is being featured in many 1944 seed catalogues. It has many tender, odd shaped leaves. Does fairly well in hot, dry weather.

Grand Rapids, Simpson, Crisp-as-Ice, Prizehead and *Hanson* are all loose-headed or leaf varieties which are worth trying on a small scale only. Don't base conclusions on one sowing. Try a short row several times.

Cos or Romaine Type

Paris White, Dark Green, Express Cos, or just plain *Cos.* This type of lettuce is worth a good trial in every home garden. I have grown it with a good deal of success and pleasure for over 20 years. It has a rather long thick leaf—does not form a compact head but will stand hot, dry conditions.

Heavy, Dark Green Type

Bibb is a new variety to most of you. A number of seedsmen are featuring it this year. It is a small semi-heading variety with thick, dark green leaves that bunch up at the bottom, bleaching to a butter yellow. It has an excellent flavor but contrary to claims made by seedsmen, I find, after several sowings over a two-year period, that it will not stand hot, dry weather.

Deers Tongue and *Matchless* are somewhat similar to Bibb but larger.

For the best lettuce you ever grew, set out some good plants of any heading variety—particularly Great Lakes—just as soon as you can get your garden ready. Don't attempt to transplant lettuce after the time the weather settles down and it is liable to be dry and hot. Good lettuce plants set early will usually produce excellent heads even under only fair growing conditions.

For best results with lettuce in the home garden:

1. Provide as good growing conditions as possible. Manure, if available; a complete fertilizer; lime if needed, and water when it gets dry.

2. Make frequent sowings of short rows of two or more varieties. Each month I sow 10 to 15 ft. of Mignonette, White Boston, Great Lakes, and Oak Leaf or Cos. This provides a steady supply of good lettuce from June 10 to November 15 (Springfield, Mass.)

3. Give the plants room to develop. Thin all head lettuce 10 to 12 inches; all leaf lettuce, including Cos, Bobb and Mignonette, 4 to 6 inches. This is very important and is the place most home gardeners run into trouble.

4. Don't attempt to plant any kind of lettuce in a garden where the soil is poor or improperly prepared and may be subject to excessive dry, hot conditions.

Wood Chemistry Enters a New Age

Condensed from American Forests

J. A. Hall

THERE should be practically complete agreement as to the desirability of getting the forest industries upon a permanent basis, geared to the productive capacity of the land, to the species and qualities of timber available, and to the various factors that operate to keep manufacture going. What are the capabilities of certain chemical developments to contribute to such a program? What about the practicability of those developments, both in the war program and the peace that will follow?

The war among materials will become more fierce when peace comes, and lasting victory for any one of them cannot be attained. In such a continuing war there are two factors that determine and maintain any temporary advantage gained—cost and serviceability. Therefore, in order to maintain any advantage for wood, there must be unceasing effort to reduce the cost of the product and improve its capacity to perform the services for which it is used. Chemistry can be of service in both respects.

Heavy transport costs on western and southern lumber have operated toward forcing the sort of selection for quality that is in direct opposition to those practices that would insure good forestry. Unfortunately, the forest does not grow trees exclusively for the high-grade lumber market. If trees are cut and manufactured only for that market, there are two major effects: the gradual deterioration of the forest, and a huge pile of sawmill and logging waste that is the larger because of the low marketability of anything but good lumber. It costs money to dispose of waste, and certainly it costs money to correct in the forest the maladjustments resulting from unbalanced cutting practices. These costs are added to the cost of lumber which, I believe, is already too high to insure its maintaining its position in a fiercely competitive system.

The cheapest way of maintaining a forest in productive condition is to harvest the increment at reasonable intervals and in a manner so balanced that when the harvest is over, all that remains to be done is to protect the forest and let it grow. That is the ideal situation.

More progress toward such management may be made by at-

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tempting to arrange for the removal of low-grade trees from the forest for conservation into useful products at a profit; for the collection and conversion of logging waste at least at a net cost less than that required to dispose of it in the woods; and for the conversion at a profit of milling and manufacturing wastes. Under this sort of system, the major part of stumpage costs must still be borne by lumber, but logging and conversion costs can be distributed, thus making possible cheaper high-quality lumber, less volume of low-quality lumber, and reasonably good harvesting practices. This, broadly, is diversified utilization.

Diversified utilization ought to be combined with what may be called integrated utilization. By this is meant utilization in which the waste material from one branch of the industry becomes the raw material of another, or several industries operating on the same log pile. There are familiar examples of this in other industries, but in the forest products industries examples are all too rare.

There are two principal lines along which chemistry may operate. First, through various means, it seems probable that the usefulness of wood itself can be greatly increased. Second, there are more and more opportunities for the chemical conversion of wood to derived materials of a wide range of usefulness.

Considering the first case, namely, the improvement of the form and usefulness of wood by chemical means, there are certain inherent properties of wood that militate strongly against its wide adaptability. For example, normal wood shrinks and swells by the taking on or giving off of moisture in accordance with atmospheric conditions. For many years scientists of the Forest Products Laboratory at Madison, Wisconsin, have studied the problem of the movement of water in wood and, having pretty well established the facts concerning this matter, they have proceeded to do something about combatting this inherent tendency. At first glance it might appear that all that need be done would be to plug up the voids or empty spaces in wood with some cheap material that would effectively seal it against the ingress and egress of water. Apparently this cannot be done because even a slight failure in such an internal surface coating allows water to enter, and essentially the same results in swelling are obtained as though no such coating were present.

A new approach was made possible by the discovery of certain forms of the synthetic resins. The trouble with most of the materials that had been attempted as fillers

for wood moisture-proofing was that they were big molecules, and the tiny submicroscopic spaces in the wood were simply smaller than the molecules the chemists were trying to introduce. The molecules of these synthetic resins are also large, but the simpler molecules from which the resins are formed are very small. Therefore, what the chemists at the Forest Products Laboratory have done is to impregnate wood with the components of these synthetic resins, and then by the application of heat to the impregnated wood, form the resin in the voids they were trying to fill. This has worked rather well. However, there is another effect. When wood is treated with the components of these synthetic resins and subjected to heat, it becomes plastic, and while the resin is being formed it can be compressed to about one-third its original volume. Thus, not only have the tiny voids of the wood been filled, but by compression the amount of empty space to be filled is greatly reduced.

Such a product is called compreg. It is hard and dense, and has the same finish all the way through. If it is scratched, the scratch can be rubbed out and the piece will have as good a finish as before. Its strength properties approach those of a mild steel.

This effect can be obtained on a solid piece of wood, or a good many thin laminations can be built up with almost any degree of orientation of properties it is desired to have. Then, because the degree to which the mass is compressed can be controlled, material can be made of almost any density required between the limits of the density of normal wood and a highly compressed specimen. Such a treatment requires clear wood, but it may be possible to use small pieces, available by dimension cutting from low-grade boards.

Important new products have been recently developed in the field of pulp and paper chemistry. There is, for example, a laminated paper plastic somewhat similar in its properties to compreg. Many sheets of paper impregnated with the components of phenol formaldehyde resin are pressed together under the application of heat, and a very hard, dense, strong product is obtained in which the distribution and orientation of strength properties can be controlled to a large extent by the way the lamination is carried out, because fibers are oriented in the direction of the operation of the paper machine.

So, even paper, potentially an important product derivable from milling and logging and forest waste, begins to take on the aspects of a broadly useful construction material which may give

the light metals heavy competition in the postwar world.

In order to utilize the potentially huge volumes of sawmill and logging and forest wastes, means must be found that will require tonnages far in excess of any of the uses discussed thus far. Such outlets must be sought in fields that can employ wood as the raw material for chemical engineering industry, manufacturing chemical products. There is nothing new about this approach, but that which is impractical in one decade often becomes practical in a succeeding one, either because of shifting economic conditions or of technological advances.

The largest potential field for the utilization of wood as a raw material for chemical engineering industry at present is offered by its conversion through hydrolysis to sugar and lignin. To effect the transformation of the cellulose and the hemicelluloses of wood to simple sugars, it was long ago determined that wood could be treated with strong acids under conditions of high temperature. The process is called hydrolysis.

During the first World War, a process for the manufacture of alcohol by the fermentation of wood sugar produced by a process of hydrolysis was developed by the Forest Products Laboratory. Briefly, it attempted to obtain the optimum yield of fermentable sugar by one digestion of wood waste in a rotary digester using dilute sulfuric acid and steam pressure. The yield was comparatively low.

In the interval between the two world wars, Scholler of Germany worked out an improvement in wood hydrolysis technique. The ground wood waste is packed in large, tile-lined, steel cylinders that are stationary and equipped with a filter cone at the bottom. Successive batches of hot, dilute sulfuric acids are introduced at the top under pressure and percolate through the wood mass to the bottom where they are successively drawn off in the form of sugar solutions, cooled, neutralized, fermented to alcohol, and distilled. By carrying on this process through a number of acid batches, all of the cellulose and hemicellulose content of the wood can be converted to simple sugars and largely recovered in fermentable form with a high yield. This is the process that the Forest Products Laboratory, in cooperation with the Office of Production Research and Development and the Cliffs Dow Company, has been operating as a pilot plant at Marquette, Michigan. Attention has been confined mostly to softwood waste.

This pilot plant operation was intended primarily to explore the applicability of the Scholler process to American species and con-

ditions and to work out such modifications in procedure as seemed desirable for adaptation in this country. The intent was to establish a broad wood base for the production of the large quantities of industrial alcohol required for the war. Results have been very encouraging. Consistent yields of alcohol in excess of fifty gallons a ton of wood waste have been obtained with relative ease. The applicability of the process to our major western and southern species has been thoroughly demonstrated.

With all known factors considered, costs per gallon of finished alcohol have been estimated in a very preliminary way. Raw material and conversion costs amount to under fourteen cents a gallon, allowing two dollars a ton to dry wood at the alcohol plant. Overhead costs depend upon rates of amortization. These cannot be calculated as yet but should not increase costs beyond the level of peacetime alcohol prices.

So, in the long run, we may contemplate a chemical engineering industry based upon wood, an industry producing from its own waste materials such as phenol and formaldehyde or other plastics, that can be incorporated into secondary manufacture of its own products, lumber and veneer. This is what is meant by integrated utilization.

The lumber industry has within its power the development of such an industry. If it does not exercise the power given it by ownership and control of the raw material resources and the facilities producing the waste pile, somebody else will do the job, once the opportunities for success are soundly established. The forest products industries can hire chemists and chemical engineers to run their chemical business. In fact, they will have to do this. But if they want to be comfortable and not be bothered by the continuous necessity of deciding whether this or that or the other product will pay its way, they should not embark in the chemical industry. There will always be something new coming up. Chemists and chemical engineers are a restless breed whose principal function in life is to take sow's ears and make from them silk purses. They are never comfortable in the presence of an unutilized waste product, and they will cost money. Occasionally they will produce a process or product that will make money—ten times or a thousand times more than it cost to develop the process or product. So, research and development along these lines requires brains and patient capital and confidence in the ability of that combination to turn waste piles into useful goods.

Home-Grown Protein Saves Laying Flock

Condensed from The Southern Planter

This may sound like a strange story but it happened on the State Department of Corrections' Southampton Prison Farm, Capron, Virginia, this summer, where 225 prisoners are producing food and fiber for the penal institutions of the Old Dominion. Six acres of tomatoes, calculated to produce fresh fruits for the convicts, were suddenly invaded by a greedy army of tomato hornworms — those big green fellows, several inches long. The bucket brigade was pressed into action. An inmate went down each row with a bucket, picking and pailing the pest as he went. Results of the first day's harvest: 90 gallons of worms. The second day, 65 gallons. And the third, 50. During the next fortnight the vines were combed twice weekly. Each time several pailsful were collected.

But that's just half the story. The acute shortage of meat scrap at the exact period was threatening to throw a flock of 400 laying hens on the farm out of production, because this animal protein element was not to be had for the laying mash.

"Feed the worms to the hens," said Sergeant J. T. McCraw. "I was raised in the country at a time when hens never saw laying mash, but they lived and laid on grain, grass and grubs. We've got all three here, so let the hens convert them into eggs."

The hens ate worms twice a day and laid like fury. And the vines, cleared of worms, produced a good crop of fine tomatoes for the convicts.

Editor's Note (from Southern Planter): Caterpillars of this type contain 65 to 80 per cent water. But the balance is comparable to meat scrap in feeding value for chickens and hogs. The dry weight of worms is about 55 per cent protein, 20 to 35 per cent fat and the rest, a variety of minor elements. Because of their green color, worms are vastly richer in vitamins than other animal proteins.

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Swine Tuberculosis Traced to Infected Poultry

Condensed from American Hampshire Herdsman

ALTHOUGH a systematic program of testing has reduced tuberculosis in cattle in Illinois to less than one-half of one per cent infection, no such record has been made in getting rid of the disease in poultry and swine on farms in the state.

Tuberculosis in poultry not only is responsible for losses in chickens, but also causes about 90 per cent of the same disease occurring in swine, according to the department of animal pathology and hygiene, University of Illinois College of Agriculture.

Federal meat inspection records for 1942 revealed that 1 out of 12 hogs slaughtered in the United States showed lesions of tuberculosis. This amount of infection caused an estimated waste of 14 million pounds of pork that was condemned as unfit for human consumption.

Tuberculosis in chickens can be controlled by selling the entire flock at the end of the first laying season if 1 per cent of the birds younger than 18 months and 9 per cent of the birds older than 18 months react to the tuberculin test, the department advises.

These figures are based on tests conducted on a total of three million pullets and older birds. There is no disadvantage in disposing of the ordinary farm flock at the end of the first laying season, since it has been found that hens lay an average of 30 per cent more eggs the first year than the second.

Valuable breeding flocks should be examined for evidence of tuberculosis by means of the tuberculin test. A diagnosis of the disease cannot be made on the basis of symptoms. Typically affected specimens should be taken to the local veterinarian for examination.

What Is "Average" Egg Production?

Condensed from American Poultry Journal

D. H. Horton

N. Y. State Institute of Agriculture

IN reading reports of experiments with poultry and studying reports of poultry farm surveys, it will be noted that there is a lack of uniformity in connection with the matter of "average egg production." The question may well be raised "What is average egg production?" There are three ways of arriving at an average; these are: (1) Hens Housed; (2) Monthly Average; (3) Hen-Day Basis.

Hens Housed

In determining average egg production on a hens housed basis, you divide the total number of eggs produced during a week, month or year, by the maximum number of hens and pullets housed during the year. This is the plan now used at all of the Standard Egg Laying Tests and is indicated by the uniform rule which reads "the records of the 13 pullets will constitute the pen record." A catalog from a prominent R. O. P. breeder contains this reference "our R. O. P. hen-housed flock average production —204 eggs per bird." This is a very significant statement because it shows that egg production is high and at the same time it shows that the number of birds which have died is low and there has been no need of heavy culling. It is the most simple method of determining average egg production and yet it gives the most complete picture of the value of a poultryman's stock.

Monthly Average

With this plan, you compute the average egg production each month and add the 12 monthly averages to obtain the year production. The number of birds on hand at the beginning of the month is added to the number on hand at the end of the month, and this total is divided by 2 to give the average number of birds for the month. Then the average total number of eggs laid during the month is divided by the average number of birds for the month to determine the average number of eggs per bird. This kind of an average gives a much higher figure than that obtained by the hen-housed basis and gives no information regarding culling and mortality.

Hen-Day Basis

Some people feel that this is the most accurate method of arriving at an average. This is true, but it is a time consuming method. It takes into account the impossibility of a bird laying eggs in the pen after she has been culled or after she has died. This method is based on the fact that 100% egg production would result from the production of an egg a day from each live bird. Suppose we use the month of January as an example. If there are 100 birds in a flock, there will be 3100 hen days for the month. But suppose that one bird dies on the 10th of the month. There are 21 days left in January during which this bird will not lay; in that case there will be 3079 hen days left (3100 —21). Suppose 4 birds are culled on the 13th of the month. There are 18 days left in January during which these birds will not lay. The number of hen days has now been reduced to 3007 ($4 \times 18 = 72$ and $3079 - 72 = 3007$). If this number of hens is divided by the number of days in the month, the average number of birds for the month is obtained; this is 97. If 1550 eggs are collected during the month, the average number of eggs per bird is 15.9, while on the "monthly average basis," the rate would be 15.8 eggs per bird; on the hens-housed basis, it would be 15. Mortality may be high and culling very heavy during the year and yet an average on a hen-day basis does not reveal this to the reader.

The Hen-housed method is coming into more general use and is the one recommended by the State Institute as the most simple and yet the most informative.

The "Ag" Class Operates This Real Farm

Condensed from Eastern States Cooperator

THIRTY-FOUR students at Quakertown High School, Pennsylvania, operate a unique farming enterprise, totaling 170 acres, to achieve distinction as operators of one of the larger FFA chapter projects in the United States. These youthful farmers, whose enterprise lies 35 miles northwest of Philadelphia, do a superior job in producing crops and caring for livestock, as well as carrying on their regular school activities. Yet they make the farm pay its way. Some of the boys come from genuine farm environment, although many are country-minded town boys who have a yen for agriculture as a career.

This outstanding project was created in May, 1939, through an idea germinated in the mind of Ray A. Poorbaugh, Quakertown High vocational agricultural teacher, and leader of the Toheka FFA chapter. The idea became a reality through the assistance of Hobart G. Biehn, member of the Quakertown board of education, and civic leader. Mr. Biehn purchased the 40-acre farm a few miles from the school as an investment. Immediately after purchase, however, he gave the Toheka chapter full use of the farm land and outbuildings, rent free. He rented to the chapter half of the duplex farmhouse for use of a resident or maintenance farmer. Joseph S. Neidig, supervising principal of Quakertown schools and the board of education, favored the project and rendered all possible assistance.

At the outset, it was necessary to secure some financial assistance to undertake the well-developed farming program planned by Mr. Poorbaugh and the FFA chapter boys. The group was able to secure financial aid locally, and issued certificates of indebtedness. While the school directors were in favor of the plan, they had no power, funds, nor authority to provide the financial structure. Some time after the project began to prove its value, the school board agreed to underwrite the program to permit future borrowing if need arose.

With the financial details arranged, Poorbaugh and his FFA boys organized a program for operating the farm, instituted good management practices, and developed it into a paying proposition. They felt there was no better way to teach farming than

Reprinted by permission from Eastern States Cooperator, Mar., 1944, Springfield, Mass.

to do farming, and after five years of operation, the project has quadrupled in acreage. The chapter is regularly paying, without difficulty, all of its current obligations, and rapidly absorbing old debts.

An important cog in the smooth functioning and success of the current program is Paul K. Detwiler, assistant teacher of vocational agriculture, and leadership assistant in the Toheka chapter. Mr. Detwiler is a Pennsylvania farm boy who shares the interest, enthusiasm, and ability of Mr. Poorbaugh.

Ray Poorbaugh and his Toheka chapter carefully and intensively worked the Biehn farm. Ambition and need soon dictated expansion, so the next step was to rent the adjacent 70-acre Cressman farm on shares. This operation was also a successful venture and again expansion was warranted. They then acquired rights to the near-by Murphy farm on a cash rental basis. This latter property included 60 acres, most of which afforded good general crop production.

The 34 boys in Poorbaugh's group range in ages from 12 to 18. Practically all of their work is carried on after school hours, on Saturdays and on Sundays. A number of them are available throughout the summer for full-time work and for which they are paid at prevailing community rates. The project boasts an accredited Guernsey herd of 10 milkers and good replacement young stock. They have 18 sows, a good boar, and a number of gilts. The capon project numbers 100 birds. The crops during the past season principally consisted of 20 acres of soybeans raised for hay, 50 acres of second-cut mixed hay, 30 acres of corn, 22 acres of oats, and eight acres of tomatoes raised on a canning contract. There is some good pasture land being developed in a definite improvement program and a substantial woodlot.

The land in the farming area where the program is conducted is a clay-type of soil, and does not lend itself to the raising of specialized cash crops. For that reason the group has designed a program to make the farm pay with a tailor-made scheme that fits the land, buildings, and equipment. The project in itself is unique, but still more unusual is the ingenuity employed by them to secure machinery for efficient dispatch of the jobs at hand. The chapter either owns or has arrangements with neighboring farmers for use of a tractor, plow, disc, mowing machine, potato digger, hay loader, milking machine, binder, hay baler, and corn planter.

One of the interesting facts about the Toheka chapter and its farm operations is that during

1943 half of the youth who participated in the farm project were boys raised in town, but who had a definite interest in agriculture as a future, and a yen to work on a farm.

Not content with doing a superior job in operating three farms, the group founded a rather completely equipped machine shop on the premises of the original holding. Here they have weekly courses of both adults and youngsters on farm machinery repair. Neighboring farmers for many miles around come in with broken and, many times, nearly worn-out equipment for Poorbaugh and his boys to rehabilitate. The machine shop is rapidly becoming the farm machinery repair center of the community.

The development of the project has not reached its climax. The program for the future calls for the acquisition of a good foundation cow, herd sire, 15 dairy cows, 500 hens, and 15 to 20 brood sows. For crops the plan is to continue growing the type of seed items which have been found to be advantageous in the past.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

A Living from Bees—By Frank C. Pellett, Field Editor of American Bee Journal. Orange Judd Publishing Co., Inc. (1943). $2.00.

America's Garden Book — By Louise Bush-Brown and James Bush-Brown. Charles Scribner's Sons (1939). $3.50.

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean of the School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $2.85.

Beekeeping — By Everett Franklin Phillips, Professor of Apiculture, Cornell University. The Macmillan Co. $4.00.

Beef Cattle — By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Sons, Inc. $4.00.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas. The Interstate Printers & Publishers (1941). $2.00.

Dairy Cattle and Milk Production — By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. The Macmillan Co. $3.90.

Dairy Science — By W. E. Petersen, Ph.D., Assoc. Prof. and Assoc. Dairy Husbandryman, Univ. of Minn. Edited by R. W. Gregory. J. B. Lippincott Company (1939). $4.00.

Farm Shop Practice—By Mack M. Jones, M.S., Agri. Engineering, Univ. of Mo. McGraw-Hill Book Co., Inc. $2.75.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. The Macmillan Co. $3.25.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.00.

Farm Management and Marketing—By V. B. Hart, Ext. Professor of Farm Management; M. C. Bond, Ext. Professor of Marketing; L. C. Cunningham, Ext. Asso. Professor of Farm Management; all of N. Y. State College of Agriculture, Cornell University. Publishers: John Wiley & Sons, Inc. (1942). $2.75.

Farm Accounting—By Donald R. Mitchell, Asst. Prof. Agri. Economics, Univ. of Wisc. McGraw-Hill Book Co., Inc. (1941). $2.50.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. (1941). $3.00.

Farm Records—By John A. Hopkins, Ph.D., Asso. Prof. of Economics, Iowa State College. Iowa State College Press. $2.50.

Gardening for Good Eating—By Helen Morganthau Fox, Gardener and Author. The Macmillan Co. $2.50.

Grow Your Own Fruit—By M. G. Kains, formerly with U. S. Dept. of Agriculture; Professor of Horticulture, Pennsylvania State College. Charles Scribner's Sons. $3.50.

Home Vegetable Gardening—By Charles S. Nissley, Extension Horticulturist in Vegetable Growing. Rutgers Univ. Press (1942). $1.50.

How to Raise Rabbits for Food and War—By Frank G. Ashbrook, Fish and Wildlife Service, U. S. Dept. of the Interior. Orange Judd Publishing Co., Inc. (1943). $2.00.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.

Livestock Production—By Walter H. Peters, Chief of the Division of Animal and Poultry Husbandry, Univ. of Minn. McGraw-Hill Book Co., Inc. $3.50.

Livestock Judging Handbook—By Julius E. Nordby, Asst. Prof. Animal Husb., Univ. Idaho, and W. Malcolm Beeson, Ph.D., Asst. Prof. Animal Husb., Univ. Idaho. The Interstate Printers. $2.60.

Livestock Judging Handbook—By Julius E. Nordby, Asst. Prof. Animal Husb., Univ. Idaho, and W. Malcolm Beeson, Asst. Prof. Animal Husb., Univ. Idaho. The Interstate Printers & Publishers. $2.60.

Plowman's Folly — By Edward H. Faulkner. University of Oklahoma Press (1943). $2.00.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry, Mo. State Univ. J. B. Lippincott Co. $5.00.

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw-Hill Book Co., Inc. $4.00.

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. The Macmillan Co. $3.75.

Practical Poultry Management—By James E. Rice, Emeritus Professor of Poultry Husbandry, and Harold E. Botsford, Extension Professor of Poultry Husbandry, both at New York State College of Agriculture. Fourth Edition (1940), John Wiley & Sons, Inc. $2.75.

Practical Horse Breeding and Training — By Jack Widmer. Charles Scribner's Sons (1942). $3.00.

Repairing Farm Machinery—By Ivan G. Morrison, Asst. Professor Agri. Education, Purdue University. The Interstate Printers & Publishers. $1.80.

Profitable Poultry Keeping — By H. Clyde Knandel, Prof. and Head, Dept. of Poultry Husb., Penn State College. Orange Judd Publishing Co., Inc. $3.00.

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Book Co., Inc. $4.00.

Sheep—By Levi Jackson Horlacher, Prof. of Animal Husbandry, Univ. of Kentucky. The Interstate Printers and Publishers. $2.00.

Soil Conservation — By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Department of Agriculture. McGraw-Hill Book Company, Inc. $6.00.

Some Common Diseases of the Horse—By George R. Conn, B.S.A.H., D.V.M., Orange Judd Publishing Co., Inc. (1942). $1.50.

Some Common Diseases of Cattle—By George R. Conn, B.S.A.H., D.V.M. Orange Judd Publishing Co., Inc. (1942). $1.50.

Soybeans—Gold from the Soil — By Edward Jerome Dies. The Macmillan Co. $1.75.

The Home Veterinarian's Handbook—By E. T. Baker, Veterinarian, Moscow, Idaho. The Macmillan Company (1943). $2.50.

The Farm Primer—By Walter Magnes Teller, formerly with the Farm Security Administration, U. S. D. A. David McKay Co. $2.50.

The Western Horse—Its Training, Type and Marketing. By John A. Gorman, Asso. Prof. Animal Production, Univ. of Wyoming. The Interstate Printers and Publishers. $1.65.

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INDEX

Fertilizers

Lime Becomes Part of Soil ..... **Oct., 1942**
Manure Yields Profits ..... **Jan., 1943**
Putting Fertilizer in Its Place ..... **Feb., 1943**
The Nitrogen Problem ..... Feb., 1944
Problems of the Soil ..... Mar., 1944
The Farmer Must "Mobilize" the Soil, Mar., 1944
Proteins from Phosphates ..... April, 1944

Hay

Hay Cutting Time Vital ..... **July, 1942**
Quality in Grasses for Pasture and Hay, April, 1943
Seeding Legumes and Grasses ..... **May, 1943**
Mow-Cured Hay ..... **June, 1943**
The Right Time to Make Hay ..... **June, 1943**
Hay Mixtures Surpass Unmixed Crop Feb., 1944
Forced Ventilation Method of Curing Hay, May, 1944

Hogs

Guard Against Soft Pork ..... **Oct., 1942**
New Hog Cholera Vaccine ..... **Nov., 1942**
Hogs on Concrete ..... **Nov., 1942**
Something New in Pigs ..... **Nov., 1942**
The Sow Herd in Winter ..... **Feb., 1943**
Get Them off to a Flying Start ... **April, 1943**
Production Testing as a Basis for Selection, April, 1943
Hog-Lot Strategy ..... **May, 1943**
Swine Erysipelas ..... **May, 1943**
Watch Out for Cholera ..... **June, 1943**
Purdue Swine Day ..... Jan., 1944
How Many Pigs? ..... Feb., 1944
Quick Maturity ..... Mar., 1944
Raise That Extra Pig ..... April, 1944
Shipping Bred Gilts ..... May, 1944
Skimping on the Feed of Pigs ..... May, 1944

Horses

Watch Out for It ..... **May, 1942**
Power of the Horse ..... **June, 1942**
Wild Horses of the Plains ..... **July, 1942**
Care of the Brood Mare ..... **Aug.-Sept., 1942**
Cooperative Selling ..... **Aug.-Sept., 1942**
Value of Good Roughage for Horses . **Oct., 1942**
Jacks and Mules ..... **Jan., 1943**
Shoeing and Shoes ..... **Feb., 1943**
Cutting Horses ..... **Feb., 1943**
Using Horses and Mules Efficiently . **June, 1943**
Notes on Elementary Training ..... May, 1944

Pastures

A Believer in Grass ..... **Jan., 1943**
Clover Pastures for the Coastal Plains, Jan., 1943
Permanent Pastures in the South .. Feb., 1943
Cow Cafeteria and New Grasses ... April, 1943
Fertilization of Pastures ..... **May, 1943**
They Like Lespedeza ..... **May, 1943**
Thin, Weedy Pastures Need Attention, June, 1943
Pastures and Their Management ... **July, 1943**
They Make Pastures Pay ..... Feb., 1944
Returns from Pasture Treatments .. Feb., 1944
Grass a Perfect Feed ..... Mar., 1944
Poisonous Plants ..... Mar., 1944
Rye Pasture Cuts Production Costs . Mar., 1944
Grassland Agriculture ..... April, 1944
Seeding the Northern Great Plains Range, May, 1944

Poultry

Turkey Flock Nets $3.12 Per Bird .. **May, 1942**
Forty Million Pounds of Nitrogen . **June, 1942**
Modern Management for Missing the Mouk, June, 1943
Chickens Pay Their Way ..... **June, 1943**
Give Them Better Grass ..... **June, 1943**
Higher Egg Quality ..... **July, 1943**
Sunflowers for Poultry Feed ..... **July, 1943**
Factors That Help Boost Income ... **Jan., 1944**
Breeding Poultry To Live Through Disease Resistance ..... **Jan., 1944**
Ducks for Meat ..... Feb., 1944
$825 from One Turkey Hen ..... Feb., 1944
Breeding for Egg Production ..... Feb., 1944
Where Guineas Reign Supreme ..... Feb., 1944
$3,000,000 Industry in Texas Broiler Capital, Mar., 1944
Better Breeding a Key to Future Profits, Mar., 1944
The Big Five in Management ..... Mar., 1944
Flock Mating Tests Point the Way . Mar., 1944
Good Management Pays ..... April, 1944
Automatic Chicken Culler ..... April, 1944
Helpful Broiler Hints ..... April, 1944
Discovery Saves Waste Feathers .. April, 1944
"We Believe in This American Goose Step," May, 1944
Nature's Miracle—the Egg ..... May, 1944
Wanted . . . More Good Ranges for Poultry, May, 1944
Broad Breasted Turkey Comes to Stay, May, 1944

Sheep

Commercial Lamb Feeding ... **Aug.-Sept., 1942**
More Profit from Sheep on Range .. **Jan., 1943**
Maintaining the Farm Flock ..... **Jan., 1943**
A Sheep Feeder Checks on Supplements, Feb., 1943
Suggestions for Southern Sheepmen . **April, 1943**
It Will Save the Lambs ..... **April, 1943**
Lambing Time ..... **June, 1943**
The Farm Flock ..... **Feb., 1944**
Phenothiazine Mixed with Salt for Sheep, Mar., 1944
Wool Quality Depends on Soil Fertility, April, 1944
Pulling Lambs ..... May, 1944
Brood Ewes Must Gain ..... May, 1944

Silage

New Methods for Grass Silage .... **Sept., 1941**
Short Cuts in Silo Filling ..... **July, 1943**

Rabbits

Domestic Rabbits for Home Consumption, May, 1943
Preparing Rabbit Meat ..... **June, 1943**

Vegetables

Growth Regulations for Celery ..... Feb., 1943
Something New in Plant Growing .. April, 1943
The Good Acre ..... **May, 1943**
Plan to Dry, Store and Can ..... **May, 1943**
Synthetic Insecticides for Vegetables . **July, 1943**
Soysprouts ..... **July, 1943**
How Long Will Seeds Live? ..... Feb., 1944
Lights Pep Tomatoes ..... Feb., 1944
Disease Control with Chloropicrin .. Feb., 1944
Hard Coal Ashes Improve Soils for Tomatoes, Mar., 1944
Scotch Farmer Gets Six Crops a Year, May, 1944
Vegetables Are Mostly Water ..... May, 1944

INDEX

Beef Cattle

Proving Beef Sires ..... Oct., 1943
Easier Cattle Feeding ..... Nov., 1943
Short-fed Cattle Mean More Profit ..... Nov., 1943
Profit or Loss in the Cattle Business ..... Jan., 1943
Cattle Rides ..... Jan., 1943
With Emphasis on Roughage ..... Feb., 1943
America's Meat Power Develops ..... Feb., 1943
Beef Production Can Be Stepped Up ..... May, 1943
Range Management ..... May, 1943
Earlier Marketing of Range Cows ..... June, 1943
Prevent Colds and Shipping Fever ..... June, 1943
Beef Cattle Feeding Trials ..... July, 1943
Feeding by Free-Choice ..... July, 1943
Progeny Testing ..... Feb., 1944
Salt Requirement of Live Stock ..... Mar., 1944
More Cattle in Alabama ..... April, 1944
Good Water Means Bigger Beef Output, May, 1944
Beef Cattle Judging ..... May, 1944

Conservation

Your Skills in Selective Service ..... June, 1943
Soil Loss Secrets Revealed ..... June, 1943
Stubble Mulch ..... July, 1943
Why Do Farmers Plow ..... Feb., 1944
Stubble Mulch in Southern Piedmont ..... Mar., 1944
Definitions of Conservation Farm Practices, Mar., 1944
Adjustment of Agriculture to Environment, April, 1944
Have Farmers Make a Plan ..... April, 1944
Shall We Try Plow Terraces? ..... May, 1944
Soil Conservation Districts ..... May, 1944

Crops

Tobacco Plant-bed Management ..... May, 1943
How Sudan Grass ..... July, 1943
Corn in the Kudzu ..... Jan., 1944
How More Bromegrass ..... Jan., 1944
How Can We Get Highest Yields ..... Feb., 1944
Trash Mulch Method for Alfalfa ..... Feb., 1944
Gomlaria Pays Off ..... Feb., 1944
Hairybeans—Alfalfa Substitute ..... Feb., 1944
Big Ears or Big Yields ..... Mar., 1944
Cover Crops Are a Sign of Good Farming, Mar., 1944
How Sweet Clovers for Every Need ..... Mar., 1944
Untying the Devil's Shoestring ..... April, 1944
Hybrid Corn Takes Over ..... April, 1944

Dairy Cattle

Grazing Habits of Cows ..... Oct., 1943
Milk Production of Cows ..... Oct., 1943
The Udder and Mastitis ..... Nov., 1943
Building a Foundation Herd ..... Nov., 1943
Feeding Vitamin A to Dairy Cows ..... Nov., 1943
Influence of High Fat Intake ..... Nov., 1943
Better Breeding Reduces Milk Costs ..... Jan., 1943
Milking Machine Sanitation ..... Jan., 1943
Proteins, Minerals, Vitamins for Reproduction ..... Jan., 1943
Sweet Clover in Texas ..... Feb., 1943
New Hormone Works Wonders ..... Feb., 1943
Water and Your Dairy Cattle ..... Feb., 1943
More Milkings—More Milk ..... April, 1943
Milking Machines—Washing and Care, April, 1944
Mating in Dairy Cattle Breeding ..... May, 1943
Efficient Milking ..... June, 1943
Ketosis in Dairy Cattle ..... June, 1943
Emergency Feeding Hints ..... June, 1943
Why Do Cows Bloat? ..... July, 1943
Thyroprotein for Sterility ..... July, 1943
Farewell to a Tough Dairy Job ..... July, 1943
More Milk Vital to Victory ..... July, 1943
Forage Milk ..... July, 1943
Dairy Goats ..... July, 1943
Calf Nutrition ..... Jan., 1944
Breeding High Testing Holsteins ..... Jan., 1944
Cuts Milking Time in Half ..... Jan., 1944
Cutting Dairy Chore Time ..... Jan., 1944
Cows Prove That They Can Take It ..... Jan., 1944
Grows All His Dairy Feed ..... Feb., 1944
Calf Nutrition—Effect on Diseases ..... Feb., 1944
First Calf Heifer Problems ..... Feb., 1944
Inbreeding and Line Breeding ..... Mar., 1944
Avoiding Avoidable Losses ..... Mar., 1944
A Critical Analysis of Artificial Breeding, April, 1944
New Knowledge of Ruminant Digestion, April, 1944
Management of Dry Cow, Calf and Heifer, April, 1944
The Value of Vigor ..... May, 1944
What We Are Learning About Range ..... May, 1944
Continuous Testing Pays ..... May, 1944
Managing the Herd for Wartime Production, May, 1944

Farm Machinery

Bale-Chute Saves Labor ..... Jan., 1943
Farm Machinery in 1943 ..... Mar., 1943
The Most from a Gallon of Gas ..... Mar., 1943
Push Button Barn Cleaning ..... Mar., 1943
How to Make the Mower Work Better, June, 1943
Device Saves Baling Wire ..... June, 1943
Good Tractor Care ..... June, 1943
New Methods Save Labor in Haying, July, 1943
The Sweep Rake ..... July, 1943
Cutting Labor Corners ..... July, 1943
What Shall I Charge ..... July, 1943
Tractors in Wartime ..... Aug.-Sept., 1943
Farm Machines Fight for America ..... Jan., 1943
Take Care of Your Machinery ..... Jan., 1943
Lubricating Farm Machinery ..... Feb., 1944
Manure Movers ..... May, 1944

Fruit

Date Growing ..... April, 1941
The Papaya in Florida ..... May, 1941
Soil Management in Orchards ..... June, 1941
The Carob Tree ..... July, 1941
Growing and Drying Prunes ..... Aug., 1941
New Spray for Apples ..... Dec., 1941
Modifying Biennial Bearing in Apples, Jan., 1943
Planning a Nut Orchard ..... Jan., 1943
Is Your Sprayer Ready ..... Feb., 1943
Economy in Pruning ..... Mar., 1943
Cover Crop Problems in Orchards ..... July, 1943
Pruning Abandoned Fruit Trees ..... Jan., 1943
Pruning Peach Trees for Production Feb., 1943
Trends in Fertilizing Apple Orchards, May, 1943
Small But Fruitful ..... Feb., 1944
Pruning Apple Trees ..... April, 1944
Blueberries for the Home Garden ..... May, 1944

COMMENTS

From Somewhere in North Africa—

"The February and March issues of the Farmer's Digest came yesterday. You should have seen with what eagnerness they were greeted by various people in this office. Even our French liaison officer wanted a copy to take home right away. I think these Digests are going to be very worthwhile."

From Somewhere in the South Pacific—

"The copy of your magazine which I receive through my subscription is enjoyed very much. It enables me to keep informed on the important agricultural topics so that when I return, after the Japs are eliminated, I can more easily go back into agricultural work."

"Before I left for the Armed Forces I had the opportunity to read several copies of the Farmer's Digest, and I was very much impressed. I feel that a digest of pertinent farm news, as found in this magazine, would be of much interest and value to me as I am as keenly interested in keeping up on agriculture as on other matters." —*Colorado*

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"I received my first issue of the Farmer's Digest and have just completed reading everything from front to back. I sincerely believe that this is a very worthwhile contribution to the agricultural field. I wish that more people could read this magazine." —*Illinois*

"Please renew my subscription to the Farmer's Digest. I find this magazine a great help to my cooperators who visit the office." *Soil Conservation Service—Georgia*

"I think a lot of the Digest and look forward to its coming. Even though I am a farmer, I am having to fill in a teaching job in the local high school where we are using the Digest a great deal in our agriculture class." —*Iowa*

"May I take this opportunity of expressing to you how much I enjoy reading the Farmer's Digest, and how useful is the information contained therein." —*Canada*

"I have had placed in my hands several copies of the Farmer's Digest and have found them very helpful. I am asking you to place me on your subscription list for the coming year." —*Iowa*